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# PROCEEDINGS

OF THE

# Bournemouth Natural Science Society.

VOL. IX.

SESSION 1916-1917.

PROCEEDINGS of the

# Bournemouth Natural Science Society.

BRITISH MUSEUM NATURAL HISTORY

:: :: VOL. IX. :: ::
SESSION 1916-1917

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# Introductory Note.

THE BOURNEMOUTH NATURAL SCIENCE SOCIETY was founded in 1903, being the successor to an older society which was formed in 1883 and dissolved in 1897. Its objects are declared by the second of its rules to be "the promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, and the formation of Sections of its members devoted to any particular branch of the Society's work."

The Sections at present working are as follows:—**Archæological and Historical, Botanical, Entomological, Geographical, Geological, Microscopical and Zoological, Photographical, and Physical.**

During the WINTER SESSION, from October to April, GENERAL and SECTIONAL MEETINGS are held. TWO GENERAL MEETINGS are usually held in each month, comprising Lectures and Demonstrations on various subjects of scientific interest, illustrated by lantern slides, diagrams, or specimens.

SECTIONAL MEETINGS.—Each Section usually holds a meeting once a month. At these meetings the papers read are more specialized and technical than at the General Meetings.

Meetings, as a rule, are held in the Society's Room in the Municipal College, but sometimes at Trinity Hall, Lorne Park.

Throughout the Summer Session, EXCURSIONS to place of interest in the neighbourhood are arranged so far as the present restricted travelling facilities permit.

The management of the Society is vested in a Council, which is elected at the Annual General Meeting, held in October.

The Members are elected by the Council, and pay an annual subscription of Ten Shillings for full membership (admitting to all meetings and excursions for the year). Visitors to Bournemouth are permitted to join for the Winter or Summer Sessions on payment of seven shillings and sixpence, if approved by the Council.

The Society is endeavouring to lay the foundations of a MUSEUM by acquiring collections of archæological, botanical, geological, zoological, and other specimens of scientific interest. A good beginning has already been made in several directions, especially by the acquisition of the valuable Dent Collection of Barton Fossils. Particulars as to the objects and hopes of the Society in this direction will be found in the special article contributed by Sir Daniel Morris to Vol. V. of the Society's Proceedings.

A Monthly Notice, giving full details of all meetings, etc., is posted to every member before the beginning of each month, and a volume of Proceedings is published every year.

**Application Forms for Membership, and further particulars, can be obtained from the**

**HON. SECRETARY,**

**Bournemouth Natural Science Society,**
**Municipal College,**
**Bournemouth.**

# Bournemouth Natural Science Society.

## OFFICERS AND COUNCIL FOR 1917–18.

### President:

Sir Jethro J. H. Teall, M.A., D.Sc., LL.D., F.R.S.

### Vice-Presidents:

Henry Backhouse, F.R.H.S.
Dr. G. E. J. Crallan, M.A., M.B., M.R.C.S.
M'Calmont Hill, D.C.L.
Jas. E. Liddiard, F.R.G.S., M.N.G.S. of U.S.A., M.J.S.
Rev. E. F. Linton, M.A., F.L.S.
Sir Daniel Morris, K.C.M.G., J.P., M.A., D.Sc., D.C.L., F.L.S.
Dr. W. T. Ord, F.G.S.
Hubert Painter, B.Sc., F.C.S.
Dr. F. G. Penrose, M.D., F.R.C.P., F.Z.S.
Dr. A. Ransome, M.A., M.D., F.R.C.P., F.R.S.
Miss C. Agnes Rooper.
R. V. Sherring, F.L.S.

### Chairman of Council:

W. Munn Rankin, M.Sc., B.Sc.

### Deputy-Chairman of Council:

Dr. F. G. Penrose, M.A., F.R.C.P., F.Z.S.

### Council:

The Officers (ex-officio) and

Henry Backhouse, F.R.H.S.
J. M. French.
Rev. C. O. S. Hatton, B.A.
T. J. P. Jeffery.
Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.
*Henry Le Jeune.
Joseph Neale, B.A.
J. H. Scott, M.E., M.I.M.C.E.
R. V. Sherring, F.L.S.
J. H. Ralph Smythe, J.P.
W. J. Woodhouse, A.C.P.

### Chairmen of Sections:

Archæological and Historical: Rev. H. Shaen Solly, M.A.
Botanical: Miss C. Agnes Rooper.
Entomological: F. G. Penrose, M.D., F.R.C.P., F.Z.S.
Geographical: Claude Lyon.
Geological: Henry Kidner, F.G.S.
Photographical and Record: R. Y. Banks.
Physical: Hubert Painter, B.Sc., F.C.S.
Zoological and Microscopical: F. G. Penrose, M.D., F.R.C.P., F.Z.S.

### Hon. Treasurer:

George Brumell, A.R.I.B.A.

### Secretaries:

*Hon. Secretary*: R. A. de Paiva, San Remo, Carysfort Road, Bournemouth.
*Assistant Hon. Secretary*: George Grace, B.S.C., A.R,C.Sc., Gwynfa, 4, Suffolk Road, Bournemouth.
*Assistant Secretary*: J. F. Spencer, Glenthorne, Richmond Park Road, Bournemouth.

### Hon. Librarian:

Henry J. Ellis.

### Hon. Curator:

W. G. Wallace.

### Hon. Editor:

Hubert Painter, B.Sc., F.C.S.

### Hon. Auditors:

E. Bicker. C. H. Blackett.

### Bankers:

National Provincial Bank of England, Bournemouth.

### Past Presidents:

| | |
|---|---|
| 1903-4 ... ... | J. E. Beale (Mayor of Bournemouth). |
| 1904-5—1905-6 . | G. E. J. Crallan, M.A., M.B., M.R.C.S. |
| 1906-7 ... ... | H. J. Waddington, F.L.S. |
| 1907-8—1908-9 . | Dr. A. Ransome, M.A., F.R.C.P., F.R.S, |
| 1909-10 ... ... | Dr. A. Smith Woodward, LL.D., F.R.S., F.L.S., F.G.S. |
| 1910-11 ... ... | Dr. Dukinfield H. Scott, M.A., LL.D., F.R.S., F.L.S., F.G.S. |
| 1911-12—1912-13 | Sir E. Ray Lankester, K.C.B., M.A., LL.D., F.R.S., F.L.S. |
| 1913-14—1914-15<br>—1915-16 ... | Sir Daniel Morris, K.C.M.G., J.P., M.A., D.Sc., D.C.L., F.L.S. |
| 1916-17... ... | The Rt. Hon. The Earl of Malmesbury, D.L., J.P. |

* Now deceased. See obituary notice in this volume.

# Annual Meeting, 1917.

THE Fourteenth Annual Meeting was held in the Society's Room in the Municipal College on Saturday, October 27th, Sir Daniel Morris, Chairman of the Council, presiding.

The Council's Report and the Hon. Treasurer's Statement of Accounts were read. The latter showed receipts £319 19s. 5d. and payments £228 0s. 9d., leaving a balance of cash in hand £91 18s. 8d., plus £47 10s. invested in £50 five per cent. War Loan. The Council's Report indicated that the Society had maintained its career of activity and usefulness. The number of Members on September 30th was 394 as compared with 406 on the same date last year. The Society had suffered the loss by death of eleven of its Members during the year.

There had been 67 Meetings and Excursions during the year. The special feature of the Lectures was a series of five popular lantern lectures on the resources of the Empire and the splendid service rendered by the Overseas Dominions in connection with the War, the subjects being Newfoundland, New Zealand, Australia, Canada, and the Crown Colonies. A small charge was made to non-members of the Society, and the net proceeds, £11 16s. 6d., were given to the Mayor's Local War Fund.

The Reports of the various sections were read by their respective Chairmen, and the Hon. Librarian presented his report.

Dr. S. McCalmont Hill, D.C.L., in appropriate words, proposed a vote of thanks to the retiring President (the Rt. Hon. the Earl of Malmesbury, D.L., J.P.).

Sir Jethro J. H. Teall, M.A., D.Sc., LL.D., F.R.S., who was for twelve years director of the Geological Survey, was unanimously elected President of the Society for 1917-18.

The Officers and Council for the year were elected, and Mr. Geo. Grace, B.Sc., A.R.C.Sc., was elected Assistant Hon. Secretary.

Sir Daniel Morris explained that the care of the Society's collections needed the appointment of a Curator, and Mr. W. G. Wallace was elected to that office as Hon. Curator.

Mr. E. Bicker and Mr. C. H. Blackett were elected Hon. Auditors, and a vote of thanks was passed to the former, who had audited the accounts for the past year.

The meeting closed with a vote of thanks to the Chairman.

An alteration in Rules 5 and 27 by the insertion of the words "Hon. Curator," rendered necessary by this appointment, was sanctioned.

# Council's Report for 1917.

IN presenting the Fourteenth Annual Report the Council is enabled to record another year of continued activity and usefulness. The number of Members on the 30th September was 394, against 406 on the same date last year.

During the year General and other Meetings were held as follows, viz.,

Annual Meeting
7 General Lectures
49 Sectional ditto and other Meetings
10 do. Excursions

making a total of 67 Meetings and Excursions.

The General Lectures were as follows:—

1915.

*Nov. 4.—" The Strange Story of the lovely Hervey Islands of the South Pacific and their interesting Peoples," by Mr. Jas. E. Liddiard F.R.G.S.

*Nov. 18.—" The River Pydel and its Tributaries: Stately Homes of Dorset," by Mr. Harry Pouncy.

* Illustrated by Lantern Slides.

During the remainder of the Session a special series of Empire Lectures was given on The Resources of the Empire and the splendid services rendered by the Overseas Dominions in connection with the War, viz. :—

Dec. 16.—" The Resources of our oldest and nearest Colony—Newfoundland," by Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.; Chairman, Sir Ralph Champneys Williams, K.C.M.G., late Governor of New foundland.

1916.

Jan. 13.—" New Zealand and the War," by the Rt. Hon. Sir Joseph Geo. Ward, Bart., P.C., K.C.M.G., Minister of Finance, late Prime Minister of New Zealand; Chairman, Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.

Feb. 17.—" Australia and the War," by the Hon. John Greely Jenkins, late Prime Minister of South Australia; Chairman, Sir Geo. Ruthven Le Hunte, G.C.M.G., late Governor of South Australia.

Mar. 16.—" Canada and the War," by Lieut.-Colonel Richard Reid, Agent-General for Ontario; Chairman, Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.

April 21.—" The Crown Colonies and the War," by Sir Everard im Thurn, K.C.M.G., C.B., late Governor of Fiji and High Commissioner of the Western Pacific, formerly Lieut.-Governor of Ceylon; Chairman, Alderman Hy. Robson, J.P., Mayor of Bournemouth.

These Lectures were illustrated by Lantern Slides, and had the sympathy and support of the Bournemouth Branch of the Royal Colonial Institute and the Victoria League. They were eminently successful in attaining the object in view. The nett proceeds, £11 16s. 6d., were given to the Mayor's Local War Fund.

Owing to the increased Railway Fares and the prohibition of the use of Motor Chars-a-banc there were no General Excursions.

The Lectures in the various Sections were as follows:—

### Archæological and Historical Section.

1916.
Nov. 16.—" Modern Inventions anticipated in Ancient Times," by Rev. Francis A. Allen, M.A.
*Dec. 8.—" Stonehenge To-day and Yesterday," by Mr. Frank Stevens, Curator of the Salisbury Museum.
1917.
*Jan. 25.—" Egyptian Antiquities," by Mr. Hy. J. Ellis and Mr. Claude Lyon.
*Mar. 24.—" Mediæval Italy," by Rev. Hy. Shaen Solly, M.A.
*Apr. 28.—" Treasures of Northern Italy," by Rev. Hy. Shaen Solly, M.A., and Mr. R. Y. Banks ((Archæological and Photographical).

### Botanical Section.

1916.
*Nov. 2.—" The Geraniaceæ," by Miss C. Agnes Rooper.
Dec. 14.—" How Wild Flowers have adapted themselves under cultivation to make Florists' Flowers," by Rev. Professor Geo. Henslow, M.A., F.L.S., F.G.S.
1917.
Feb. 24.—" Elementary School Gardens," by Miss C. Agnes Rooper.
Mar. 13.—" The Names of Plants," by Rev. J. E. Kelsall, M.A.
April 4. " Some additions to the Purbeck Flora," by Mr. C. B. Green.
May 5.—Exhibition of Fresh Wild Flowers, by Miss C. Agnes Rooper.
July 7.—Do. do. do.

### Entomological Section.

1916.
Dec. 7.—" A Description of the Modes of setting Insects and of preserving Larvæ," by Mr. W. Parkinson Curtis, F.E.S.
1917.
*Jan. 11.—" Colour Protection among Insects," by Mr. Geo. Grace, B.Sc., A.R.C.Sc.
*Jan. 11.—" Demonstration of the Method of preserving Caterpillars," by Mr. W. Parkinson Curtis, F.E.S.
Feb. 8.—Discussion on the Clouded Yellow Butterflies (*Colias edusa and hyale*).
Apr. 26.—Exhibition of the Blue forms of Females of the British Lycænidæ.
May 17.—Exhibition of living Larvæ, etc.
June 14.—Exhibition of Clear Wings.
July 19.—Exhibition of Larvæ, etc.

### Geographical Section.

1916.
*Nov. 11.—" The Beauties of Japan," Part I., by Mr. Claude Lyon.
*Dec. 18.— do. Part II. do.
Dec. 20.—" A School Geography Room and its Equipment," by Mr. Jos. Scattergood.
Feb. 3.—" Geography and Nationality," by Mr. C. B. Fawcett, B.Litt., M.Sc.
*Mar. 10.—" The Egyptian Antiquities kindly presented to the Society by Mrs. Philpott," described by Mr. Claude Lyon.
*Mar. 31.—" Byzantium and Constantinople," by Mr. Claude Lyon.
June 9.—" Map-making and Map-reading," by Mr. W. J. Woodhouse, A.C.P.

## Geological Section.

1916.

*Nov. 9.—" The Chalk Ocean," by Mr. Hy. Kidner, F.G.S.

*Dec. 6.—" The Scenery of the English Lakeland," by Mr. Geo. Grace, B.Sc. (Hons.) Lond, A.R.C.Sc.

1917.

Jan. 17.—

(1) " The Geology of Kimmeridge Clay in Dorset and in other parts of England and in France," by Mr. W. Munn Rankin, M.Sc., B.Sc.

(2) " A Note on Physiological Evidence as to the original sources of the Organic Matter in Oil Shales," by Dr. Stanislaus Pinkus, Ph.D.

Jan. 31. " The Chemistry of the Kimmeridge Shale, Coal, and Oil, with particular reference to the difficulty of Extracting the contained Sulphur," by Mons. A. Teichfeld,

*Feb. 7.—" The Geology of the Franco-German Borderland," by Mr. W. Munn Rankin, M.Sc., B.Sc.

Feb. 21.—"Kimmeridge and other Oil Shales," by Mr. A. J. G. Swinney, M.E., M.Inst. M. & M.

Mar. 7.—" Symposium on Problems of Kimmeridge Clay and Oil," in which Mr. W. Munn Rankin, Mr. Swinney, Mr. Kidner, and Mr. Grace took part.

*Mar. 21.—" A Geological Ramble along the Purbeck Coast," by Mr. W. Munn Rankin, M.Sc., B.Sc.

*April 25.—" The Glacial Geology of Furness," by Mr. Geo. Grace, B.Sc., A.R.C.Sc.

## Photographic and Record Section.

1916.

*Nov. 25.—Opening Meeting of the Session, " Amateur Photographer " Prize Slides of 1916 shown by Mr. R. Y. Banks.

*Dec. 9.—Exhibition of Lantern Slides taken by Members, shown by Mr. R. Y. Banks.

1917.

*Jan. 10.—" Bournemouth Past and Present," by Mr. Chas. Riddle, Borough Librarian.

*Feb. 10.—" Photography and Focus " Prize Slides, shown by Mr. R. Y. Banks.

*Mar. 28.—" The Photography of familiar Trees," by Mr. E. Dodshon, LL.B.

## Physical Section.

1916.

Dec. 2.—" Electrical Power Transmissions," by Mr. C. H. Woodward, A.M.I.E.E.

1917.

*Jan. 6.—" The Chemistry of Flour and Bread," by Mr. W. J. Woodhouse, A.C.P.

Mar. 3.—" Salt : its occurrence in Nature, Preparation and Uses," by Mr. H. Painter, B.Sc., F.C.S.

1917.

*Apr. 14.—" Sugar : its Chemistry, Sources, and Production," Part I., by Mr. H. Painter, B.Sc., F.C.S.

May 12.—" Sugar : its Chemistry, Sources and Production," Part II., by Mr. H. Painter, B.Sc., F.C.S.

June 12.—" The Velocity of Sound," and " Coal Gas and other Products of the distillation of Coal," by Mr. H. Painter, B.Sc., F.C.S.

## Zoological and Microscopical Section.

1916.

Dec. 7.—Demonstration of some of the Lantern Slides of the Batley Collection, by Dr. F. G. Penrose, M.D., F.R.C.P., F.Z.S.

1917.
Feb. 15.—Exhibition of Slides of interest, by Dr. F. G. Penrose, M.D., F.R.C.P., F.Z.S., Mr. H. B. Wells, and Mr. F. B. Taylor, B.A.

* Illustrated by Lantern Slides.

In the Botanical Section much interesting work was done by Miss C. Agnes Rooper, who arranged, during the Summer, a weekly display of fresh wild flowers in the vestibule of the Public Library, by kind permission of the Library Committee. Miss Rooper was ably assisted by Mrs. Rothwell, Miss E. S. M. Jeffery, Mr. H. E. Swain, and others.

The Excursions in the various Sections and their Conductors were:—

1917.
May 24.—Wimborne, Rev. Hy. Shaen Solly, M.A., and Mr. S. C. Ryley (Archæological).
May 26.—Christchurch Meadows, Mr. C. G. Seeviour, A.C.P., F.R.H.S. (Botanical).
June 2.—Corfe Castle, Dr. F. G. Penrose, M.D., F.R.C.P., F.Z.S. (Entomological).
June 23.—Hinton Admiral, Rev. C. O. S. Hatton, M.A. (Botanical).
July 10.—Christchurch Priory, Rev. Hy. Shaen Solly, M.A., and Mr. H. J. Ellis, assisted by Mr. Geo. Brownen, F.C.S. (Archæological and Historical).
July 14.—The Blue Lake, Mr. W. Munn Rankin, M.Sc., B.Sc., Mr. C. B. Green, Dr. F. G. Penrose, M.D., F.R.C.P., F.Z.S., and Mr. R. Y. Banks (Geological, Botanical, Entomological, and Photographical).
July 17.—Poole Gas Works, Mr. Hubert Painter, B.Sc., F.C.S., and Mr. Claude Lyon (Physical and Geographical).
Aug. 15.—Pottery Works of Messrs. Sharp, Jones & Co., Mr. H. Le Jeune and Mr. Claude Lyon (Physical and Geographical).
Aug. 18.—The Bourne Valley, Mr. Claude Lyon and Mr. W. J. Woodhouse, A.C.P. (Geographical).
Aug. 22.—Milton Rectory, Rev. J. E. Kelsall, M.A. (Botanical).

At the last Annual Meeting held in the Society's Room, Municipal College, on October 28th, 1916, the Rt. Hon. the Earl of Malmesbury, D.L., J.P., was unanimously elected President. The Meeting of the British Association, which was to have been held in Bournemouth this year, was abandoned owing to the exigencies of the War. It is possible the meeting may be held in Bournemouth in 1919.

The Council has to record the loss by death of two of its body, viz., Mr. Thos. Capper, M.A., B.Sc., who had been Joint Hon. Secretary for nearly three years, and of Mr. Robt. O'Brien Furlong, C.B., M.A., J.P., Vice-Chairman of Council, 1915-16.

The Society has also suffered the loss by death of several of its Members, viz., Dr. J. Roberts Thomson, M.D., F.R.C.P., J.P., who was an original Member of the Society and took the chair at its first Meeting in 1903. He was a Vice-President since 1905; Dr. John Moorhead, M.A., M.D., J.P.; Mr. Robt. Druitt, Mr. Aubrey Edwards, Mr. Alfred Frewin, Colonel J. M. Heywood, and Mr. Chas. Isaacs; also two Honorary Members, Rev. O. Pickard-Cambridge, M.A., F.R.S., and Mr. Clement Reid, F.R.S., F.L.S., F.G.S. An obituary notice of Mr. Reid appeared on page 15 of Vol. VIII of the Proceedings.

The principal donations to the Society were several books referred to in the Librarian's Report, and

A number of valuable Egyptian Antiquities, presented by Mrs. Philpott;

About 150 negatives of Egypt, presented to the Society by Mrs. Philpott, being the work of her late husband.

(Two Cameras with which the negatives were taken were presented by Mrs. Philpott to the Chairman of the Photographic Section for his use during life, when they were to become the property of the Society. The Chairman, Mr. R. Y. Banks, has, however, handed them over now, so that Members may be able to use them as occasion requires)

A number of Lantern Slides belonging to the late Dr. Alfred Wallace, presented by Mr. W. G. Wallace and Miss Wallace;

A number of Fossils, representative of all the chief formations, collected by the late Mr. G. Comerford Casey, M.A., presented by Mrs. Casey.

In conclusion, the Council desires to record its appreciation of the kindness of Mr. Arnold Pike for permission to visit the Blue Lake; to Mr. P. G. G. Moon, Manager of the Poole Gas Works; and to Mr. Chas. Sharp, proprietor of the Bourne Valley Pottery Works; and also to express its best thanks to the Lecturers and Conductors of Excursions, in which Mr. Geo. Brownen, F.L.S., rendered valuable services at Christchurch Priory, for their services, which have been much appreciated.

# Summary of Cash Account for the Year ending 30th September, 1917.

## RECEIPTS.

| | | | | Amounts for previous year. | | |
|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. |
| Balance at Bank on 1st Oct., 1916 | 133 | 4 | 10 | 99 | 12 | 11 |
| Members' Subscriptions ... ... | 168 | 17 | 6 | 174 | 12 | 6 |
| Sales of Volumes of Proceedings ... | 0 | 11 | 0 | 1 | 16 | 3 |
| Sales of Natural History of Bournemouth ... ... ... ... | 0 | 13 | 4 | 3 | 11 | 8 |
| Surplus from Excursions ... ... | 2 | 15 | 6 | 12 | 12 | 4 |
| Net proceeds from War Lectures ... | 11 | 16 | 6 | | | |
| Donations towards cost of Bookcase | 1 | 10 | 0 | | | |
| Dividend on War Loan, less Tax ... | 0 | 10 | 9 | | | |
| | £319 | 19 | 5 | | | |

## PAYMENTS.

| | | | | Amounts for previous year. | | |
|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. |
| Rent of Room, Municipal College | 35 | 0 | 0 | 35 | 0 | 0 |
| Hire of Trinity Hall ... ... | 3 | 2 | 6 | 3 | 15 | 0 |
| Salary of Assistant Secretary ... | 10 | 0 | 0 | 10 | 0 | 0 |
| Printing and Stationery ... ... | 23 | 5 | 6 | 19 | 13 | 1 |
| Vol. VIII. of Proceedings ... ... | 30 | 13 | 11 | 27 | 17 | 3 |
| Furniture and upkeep of Room ... | 16 | 7 | 2 | 3 | 16 | 8 |
| Expenses of Lectures ... ... | 12 | 9 | 6 | 18 | 16 | 5 |
| Postage ... ... ... ... | 13 | 18 | 7 | 12 | 14 | 1 |
| Subscriptions to other Societies ... | 3 | 12 | 0 | 2 | 17 | 0 |
| Insurance ... ... ... ... | 2 | 0 | 10 | 1 | 7 | 7 |
| Purchase and preparation of collections of Natural History specimens and Photographic records, including final instalment of £5 for the Batley Collection ... | 6 | 15 | 1 | 19 | 7 | 4 |
| Books ... ... ... ... ... | 9 | 15 | 0 | 4 | 14 | 9 |
| The Mayor's Fund, proceeds of War Lectures ... ... ... | 11 | 16 | 6 | | | |
| £50 War Loan ... ... ... | 47 | 10 | 0 | | | |
| Sundries ... ... ... ... | 1 | 14 | 2 | 2 | 1 | 8 |
| | £228 | 0 | 9 | | | |
| Balance at Bank ... ... | 91 | 18 | 8 | | | |
| | £319 | 19 | 5 | | | |

We have examined the foregoing Account with the books of the Society and the Vouchers for payments, and the War Loan Certificate, and certify the same to be correct.

EDWARD BICKER, F.S.A.A.

Bournemouth, 19th October, 1917.

# Hon. Librarian's Report, 1916-17.

I have to report that during the session the Society has received a number of additions to its Library. The chief of these are:—

1.—" Nature-Printed British Seaweeds," by W. Johnstone and O. Croall (1859-60), 4 vols. Presented by the Botanical Section.

2.—" A Century of Scientific Thought and other Essays," by Sir Bertram Windle, F.R.S. (1915). Presented by the Rev. M. H. Windle Cooper, M.A.

3.—" Stonehenge," by Frank Stevens (1916). Presented by Dr. F. G. Penrose, M.D., F.R.C.P., F.Z.S.

4.—Four pamphlets on Natural History by the late W. Omer Cooper. Presented by J. Omer Cooper.

5.—Five volumes dealing with Ancient Egypt, viz:—" Memphis," " Athribis," " Qurneh," " Gizeh and Rifeh," " Hyksos and Israelite Cities," by Professor Flinders Petrie (1906-1909). Presented by Mrs. Philpott.

6.—" The American Geographical Review," Vols. II. and III. (July, 1916-June, 1917); " The American Museum Journal, Vol. XVI. (1916); " American Bird Lore," Vol. XVIII. (1916). Presented by the late Mr. G. R. MacDougall.

7.—" Record of a Pre-historic Industry in Tabular Flint, at Bainbridge and Highfield, near Southampton, by R. E. Nicholas, F.L.S., F.G.S. (1916). Presented by Mr. H. J. Ellis.

8.—" On Roman Triple Vases," by W. J. Kaye (1914). Presented by Mr. E. Dodshon.

9.—" From Harbour to Harbour," by Mrs. A. Bell (1916). Presented by Mr. J. M. French.

10.—" The Geology of Weymouth, Portland and Coast of Dorset," by R. Damon, F.G.S. (1884). Presented by Mr. F. Lattey.

11.—" Dictionary of Arts, Manufactures and Mines " by Dr. A. Ure, 4 vols., 7th edition, by R. Hunt, F.R.S. (1878). Presented by Mr. J. T. Arundell.

12.—The Quarterly Journal of the " Geological Society " from May, 1878-September, 1917, has been purchased. Also Mansel-Pleydell's " Mollusca of Dorset " (1898), and a few other works on Natural History.

13.—The " Journals of Botany " and of " Ecology," " Knowledge," the publications of the " Palæontographical Society " and of the " Geographical Association," and a few other works are received annually by subscription.

The annual volumes of our " Proceedings " are exchanged regularly with a number of societies having kindred scientific aims with ourselves:—

1.—Ashmolean Natural History Society of Oxfordshire.
2.—Belfast Naturalists' Field Club.
3.—Cambridge Antiquarian Society.
4.—Caradoc and Severn Valley Field Club.
5.—Chester Society of Natural History.
6.—Cotteswold Naturalists' Field Club.
7.—Croydon Natural History and Scientific Society.
8.—Dorset Natural History and Antiquarian Field Club.
9.—Hampshire Field Club and Archæological Society.
10.—Hastings and East Sussex Natural History Society.
11.—South London Entomological and Natural History Society.
12.—Torquay Natural History Society.
13.—South-Eastern Union of Scientific Societies.

During the year 1917 a committee was appointed to revise the " Rules " of the Library, and these in their amended form were duly issued to members.

Other measures have since been under consideration to increase the utility of the Library for the work of the different sections by acquiring up-to-date text books, the results of which will appear in the report for 1917-1918.

H. J. ELLIS, Hon. Librarian.

## British Association.

As the British Association did not hold its usual meeting in 1917 there is no Delegate's Report to be inserted.

# Obituary Notices.

(28th October, 1916—28th February, 1918).

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## CLEMENT REID, F.R.S., F.L.S., F.G.S.

Died—December 10, 1916.

The death of this distinguished honorary member occurred before the publication of Volume VIII., and an obituary notice was inserted in that volume (page 15).

## JOHN MOORHEAD, M.A., M.D., J.P.

Died—December 29, 1916.

Dr. Moorhead joined the Society in 1908. On February 9th, 1909, he gave a lecture on "The Geology of Portland." Although he was never an officer of the Society, he was well-known to the majority of the members, being very regular in his attendance at the meetings. During his long life he had come into personal contact with very many distinguished men of science and he had an extensive knowledge of many scientific subjects. He frequently spoke at meetings and often made valuable contributions to the discussions following the lectures.

## COLONEL J. M. HEYWOOD.

Died—February 19, 1917.

Colonel Heywood was one of the early members, having been elected in 1905.

## REV. O. PICKARD-CAMBRIDGE, M.A., F.R.S.

Died—March 9th, 1917.

This distinguished naturalist, one of the greatest of English authorities on spiders, was elected an honorary member in 1914. He presented to the Society's library a copy of his book "The Spiders of Dorset." His collections at Bloxworth Rectory were of great value; some of our members have, at various times, had the privilege of examining them.

## CHARLES ISAACS, J.P.

Died—April 26, 1917.

Mr. Isaacs was elected to membership in 1915. The state of his health did not permit him to be a very frequent attendant at meetings, but he came to several, especially in the Archæological and Physical Sections.

## ROBERT DRUITT.

Died—May 9, 1917.

Mr. Druitt was a member of a family long and prominently associated with Christchurch and Bournemouth. He joined the Society in 1913.

## AUBREY EDWARDS.

Died—May 4, 1917.

Mr. Edwards joined the Society in 1912, and, when his health permitted, frequently attended the meetings. On December 7th, 1912, he read a paper on "The Swifts" before the Zoological Section; this was published in Vol. V. of the Proceedings. On November 20th, 1913, he lectured on "Some Bournemouth Birds." Both papers contained the record of much personal observation. Mr. Edwards presented to the Society's library 23 volumes of the "Selborne Magazine."

## ALFRED FREWIN.

Died—May 3, 1917.

Mr. Frewin was elected in 1911.

## ROBERT O'BRIEN FURLONG, C.B., M.A., J.P.

Mr. Furlong joined the Society in 1911, was elected a member of the Council on October 31, 1914, and became Deputy-Chairman in February, 1916. He was greatly respected by his colleagues, several of whom represented the Society at his funeral.

## THOMAS CAPPER, M.A., B.Sc.

Died—August 15, 1917.

Mr. Capper settled in Bournemouth after his retirement from the important position he had held for many years in Jamaica. He joined the Society in 1913, and, at the Annual Meeting in October, 1914, was elected Joint Hon. Secretary with Mr. de Paiva. This office he held till his death and he rendered much valuable service in its discharge. Mr. Capper lectured on "Jamaica and its People" on April 4, 1913, and on the question "Are there other Inhabited Worlds?" on February 29th, 1916. These lectures were given in the Geographical and Physical Sections respectively.

## JOHN ROBERTS THOMSON, M.D., F.R.C.P., J.P.

Died—September 11, 1917.

Dr. Roberts Thomson was one of the original members of the Society and Chairman of the meeting at which it was founded in 1903. He was the first Chairman of Committee and was appointed Vice-President in 1905. In the latter capacity he presided at various General Meetings. Dr. Thomson took a prominent position in many departments of public life in Bournemouth. For an account of his many beneficent activities outside our Society reference may be made to the biographical notices in the "Bournemouth Visitors' Directory" and the "Bournemouth Guardian" of September 15th, 1917.

BRITISH MUSEUM
NATURAL HISTORY

HENRY LE JEUNE.

## HENRY LE JEUNE.

Died—December 18, 1917.

Mr. Le Jeune was the son of the late Mr. H. Le Jeune, A.R.A. In his youth he was a student at the Royal Academy Schools, where his father occupied an important position, but afterwards he qualified as a Marine Engineer. During his professional life he was associated with the large firm of Messrs. John Penn and Sons, of Greenwich. On his retirement, at the age of 50, he settled in this district. In 1899 he was elected a member of the Dorset Field Club and joined our own Society in 1906. In February, 1909, he read an important paper before the Archæological Section; this was printed in the Proceedings, Vol. I. He was elected Hon. Secretary at the Annual Meeting of November, 1910, and, although he only held this office for one year, he continued to render most valuable services to the Society both as member of the Council and, especially, in conection with the arrangement of excursions. Later, he became Secretary of the Archæological Section, and, still later, Acting Secretary of the Physical Section. Numerous and successful were the Archæological excursions he planned and conducted during his Secretaryship. Many of the members of the Society will always retain pleasant memories of the antiquarian knowledge he so freely placed at their disposal and of the interesting, thorough and practical arrangements he made for these excursions, so much enjoyed by those who took part in them. Perhaps no one in the district had a closer knowledge of, or greater love for, East Dorset and its many objects of archæological interest. His knowledge of local geology was also considerable.

At the time of the meeting of the South-Eastern Union of Scientific Societies, held in June, 1914, he gave much assistance in arranging excursions and was the author of "The Archæology of East Dorset," an excellent summary of the subject contributed to the Official Handbook edited by Sir Daniel Morris for the use of the meeting.

On the outbreak of war, notwithstanding his age, he gave gratuitously his expert knowledge of metal turning and engineering drawing to that work for freedom in which so many have been engaged.

Mr. Le Jeune made many presentations to the Society, both of books for the library and of archæological and other objects for the Museum. His election as an Honorary Member of the Society in March, 1917, was a well deserved acknowledgment. of the great debt which the Society owed to one of its most valued members.

## MRS. DE PAIVA.

Died—December 18, 1917.

Mrs. de Paiva joined the Society in 1910 and was often present at the meetings. Those members who had the privilege of her personal acquaintance feel for themselves the loss of a lady of a gracious personality, while, in common with others, they sympathise with our universally esteemed Hon. Secretary in his bereavement.

## GEORGE ROGERS MACDOUGALL.

Died—December 25, 1917.

Although Mr. MacDougall joined the Society so recently as 1916 he took a keen interest in its proceedings and was a most generous benefactor. He was a Greenock man and had lived for many years in New York, where he occupied a leading position in the sugar trade, retaining, however, his British nationality. He was much interested in literature, art and science, and one of his chief recreations was the study of trees. When he retired from business and settled in Bournemouth he continued his interest in trees under the very favourable conditions existing in this neighbourhood. A few months before his death he made a generous offer to Sir Daniel Morris to bear the cost of bringing out a "Guide to the Trees and Shrubs in the Bournemouth Gardens," the property in the book to be vested in the Natural Science Society. This work will be a companion volume to "The Natural History of Bournemouth and District." The estimated cost of production, with illustrations and detailed plans, being £160, Mr. MacDougall sent a cheque for that amount to Sir Daniel Morris. He also lent to the Society a valuable collection of Egyptian antiquities, and, further, bequeathed, subject to the life-interest of two legatees, the sum of £2,000 as a nucleus of a fund for establishing a Museum.

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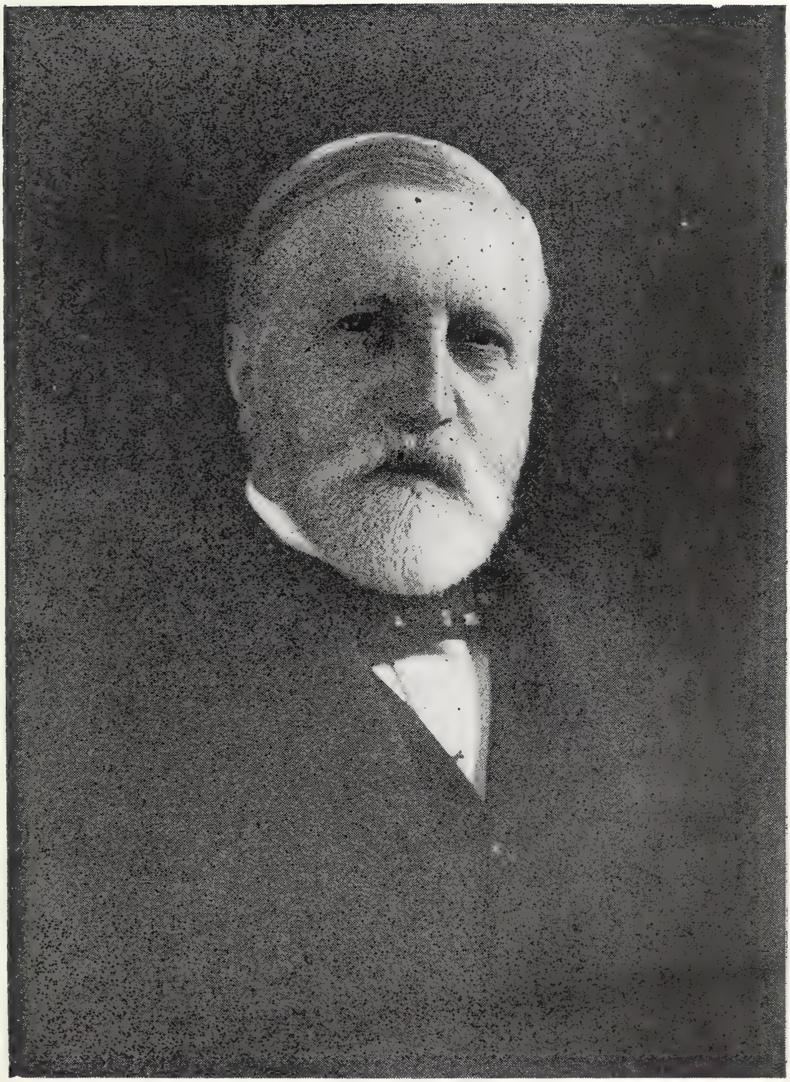

GEORGE ROGERS MacDOUGALL.

BRITISH MUSEUM
NATURAL HI

# List of Members.

*Revised to 4th February,* 1918.

* HONORARY MEMBERS. † PAST PRESIDENTS. O ORIGINAL MEMBERS.
A ASSOCIATE MEMBERS.
Members elected since August 1st in Italics.
Members resigned since September 30th in brackets [......].
The year of election is given before the name of each member.

## A

| | | |
|---|---|---|
| 1912 | Alabaster, Lady | Dil Aram, 36, Sea Road, Boscombe |
| 1905 | Alder, Mrs. | East Grove, Lymington |
| 1908 | Alder, Miss Evelyn | ,, ,, |
| 1913 | Alexander, Saml. J. | Abbotslea, 5, Surrey Road |
| 1911 | Allan, Alexr. | Bylands, Boscombe Cliff Road |
| 1911 | Allen, Rev. F. A., M.A. | Staffa, Wellington Road, Parkstone |
| 1906 | Allis-Smith, Miss E. | Martello Towers, Branksome Park |
| 1911 | [Allwood, Miss C. A.] | The Chimes, 5, Crabton Close Road |
| 1914 | Andrews, W. | Chineside, 15, Studland Road |
| 1912 | [Anstice, Mrs.] | Bryher, Tower Road |
| 1914 | Anthony, H. E. | Rosendale, Branksome Wood Road |
| 1905 | Archer, J. W. | Windlesham, 5, Braidley Road |
| 1905 | Archer, Mrs. | ,, ,, |
| 1913 | Armstrong, Mrs. | 27, Cecil Road, Boscombe |
| 1915 | Arundel, John T., F.R.G.S. | Savoy Hotel, Bournemouth |
| 1911 | Atkins, W. | The Hermitage, 40, Wimborne Road |
| 1911 | Atkins, Mrs. | ,, ,, |
| 1915 | Atkins, Miss Bessie | Glen Lee, 10, Alumdale Road |
| 1916 | Austen, Mrs. B. Tennant | Athelstan, Queen's Park Road |

## B

| | | |
|---|---|---|
| 1906 | Backhouse, Hy., F.R.H.S. | Yelland, 23, McKinley Road |
| 1910 | Bain, Mrs. | 14, Oxford Avenue, West Southbourne |
| 1914 | Banfield, Col. R. J. F., C.B. | Park View, 42, Poole Road |
| 1905 | Banks, R. Y. | Egerton, 12, Portchester Road |
| 1905 | Barlow, E. W., B.SC., F.R.A.S. | 32, New Park Road, West Southbourne |
| 1915 | [Barnes, Oliver Geo.] | Glen Lee, 1, Suffolk Road |
| 1912 | A Barraclough, Aug., M.A. (Cantab.), F.R.G.S. | 56, Richmond Wood Road |
| 1909 | Barratt, J. Hayes | Brundon, 2, Surrey Road |
| 1914 | Barrington, W. J. | Heather Dene, Penn Hill Avenue, Parkstone |
| 1918 | *Bartle, Miss M. Marjorie* | Braemar, Longfleet Road, Poole |
| 1905 | Bartlett, H. F. D., F.E.S. | 1, Myrtle Road, Richmond Park |
| 1914 | Bartlett, T. O. | Wilts and Dorset Bank, Westbourne |
| 1918 | A *Beaumont, Miss E. J.* | 60, Fitzharris Avenue |
| 1910 | [Beck, Rd., F.E.S.] | Red Lodge, 49, Portchester Road |
| 1917 | Belcher, Taswell Ed. | Trefloyne, Sandringham Road, Parkstone |
| 1909 | Benison, F. | Aldborough House, 14, Rosemount Road |
| 1909 | Benison, Mrs. | ,, ,, |
| 1917 | Bennett, Douglas, B.A. | Woodlands, Parkstone |
| 1905 | Bennett, Miss E. C. | 85, Talbot Road, Winton |
| 1904 | Bennett, H. Morden | Manor Lodge, 20, Manor Road |
| 1916 | A [Benus, Miss R. L.] HONS. B.A., Lond. | High School, Norwich Avenue |

| | | |
|---|---|---|
| 1916 | [Beyerhaus, Miss Minnie] | Westbourne High School, Pine Tree Glen |
| 1913 | Bilton, Miss C. E. | Dilkhush, 25, Parkwood Road, Boscombe |
| 1912 | Blackall, Miss E. E. | 10, Harcourt Road, Boscombe Park |
| 1908 | Blackett, C. H. | Rosapenna, 16, McKinley Road |
| 1908 | Blackett, W. Eggleston | Blanchland, 21, McKinley Road |
| 1915 | Blondel, Mrs. | Redroofs, Ipswich Road |
| 1916 | Bloomfield, Rev. H., M.A. | Moordown Vicarage |
| 1917 | *Blundell, Miss M. J.* | 4, The Maisonette, Vale Road |
| 1910 | *Bond, F. Bligh, F.R.I.B.A. | 454, Gloucester Road, Bristol |
| 1916 | Booth, Miss | Boscombe Grange, Percy Road |
| 1914 | Bradbury, Miss | La Bocca, 2, Portarlington Road |
| 1914 | Bradbury, Miss Alice | ,, ,, |
| 1914 | Bradbury, Miss Edith | ,, ,, |
| 1908 | Brazier, J. J. | Fairlawn, 48, Lowther Road |
| 1917 | ABrett, Lloyd | 10, Warwick Road, Boscombe |
| 1916 | [Brettingham, Mrs. E. B.] | 1, Waterloo Place, Christchurch |
| 1914 | Bright, Percy, F.E.S. | 26, Portchester Road |
| 1917 | *Brown, Edward* | Wood End, Chessel Avenue |
| 1917 | *Brown, Mrs.* | ,, ,, ,, ,, |
| 1917 | *Brownen, Geo.*, F.C.S. | Talnas, Grove Road, Christchurch |
| 1916 | Brownworth, Miss Edith M. | Stoneleigh, Heron Court Road |
| 1905 | Brumell, Geo., A.R.I.B.A. | Maori, Richmond Park Avenue |
| 1916 | Bryant, Mrs. | Wolverton, 44, Alum Chine Road |
| 1907 | Bulfin, Ignatius, B.A. | The Den, 26, Knole Road |
| 1908 | Bulfin, Mrs. | ,, ,, |
| 1915 | Burton, Jas. | 163, Richmond Park Road |
| 1916 | [Byfield, Miss D.] | Fern Coombe 11, St. Stephen's Road |

## C

| | | |
|---|---|---|
| 1910 | Cameron, Miss | Little Forest House, 19, Bath Road |
| 1913 | [Capper, Thos.] M.A., B.SC., deceased | Ropley, Stirling Road |
| 1912 | Carus-Wilson, C., F.R.S., Edin., F.G.S. | Altmore, Waldegrave Park, Strawberry Hill, Middlesex<br>and Royal Societies' Club, S.W. |
| 1909 | Chandler, S. Whitty, B.A. | St. George's, Cecil Road, Boscombe |
| 1909 | Chapman, Miss | Penrhyn, Chessel Avenue, Boscombe Manor |
| 1912 | Charsley, Mrs. | Camborne, Belle Vue Road, Southbourne |
| 1912 | AChilver, Miss Kathleen M. | 79, Richmond Park Road |
| 1911 | Clark, Walter Child | Michelgrove House, Boscombe |
| 1917 | *Clifford, Miss Winsloe* | 6, Walpole Road |
| 1905 | Coddington, E. F. | St. Frideswide, 94, Southbourne Road |
| 1918 | Colebrook, H. W. V. | Lynton, 64, Lowther Road |
| 1911 | Collins, W. F. | Vellore, Overcliff Drive |
| 1911 | [Compton, Rev. D. G.] | The Downs, Clifton Road, Southbourne |
| 1908 | Cooke, F. I. | Corona, Annerley Road |
| 1912 | Cooper, Ernest | 100, Old Christchurch Road |
| 1909 | Cooper, Mrs. J. Omer | 6, Queensland Road, Boscombe |
| 1909 | Cooper, J. Omer | ,, ,, ,, |
| 1908 | Cooper, Rev. W. H. Windle, M.A., F.R.G.S. | The Birks, 2, Branksome Wood Road |
| 1910 | Cooper-Dean, Mrs. | The Old Vicarage, Pokesdown |
| 1916 | Corner, Rev. Arthur E. | Eversley, Branksome Avenue |
| 1917 | Corrie, E. Rowland | Coombe Wood, Balcombe Road, Branksome Park |
| 1917 | *Corrie, Mrs.* | ,, ,, ,, |

| | | |
|---|---|---|
| 1914 | Cotes, Sir Merton Russell, J.P., F.R.G.S., M.J.S. | East Cliff Hall |
| 1914 | Cotes, Russell, Lady, F.R.S.L., M.J.S. | ,, ,, |
| 1913 | Cotes, H. V. M. | Meyrick Park House, Meyrick Park |
| 1916 | Cowell, Geo. Edmund | The Hawthorns Hotel |
| 1904 | Cowie, Dr. C. G., M.A., M.D. | Bonaccord, Westminster Road |
| 1903o† | Crallan, Dr. G. E. J., M.A., M.B., M.R.C.S. | Gouray Lodge, Gorey, Jersey, Channel Islands |
| 1905 | [Crespi, Dr.] | Cooma, Poole Road, Wimborne |
| 1917 | *Crosby, Chas.* | Corbett House, Stroud, Glos |
| 1917 | *Crosby, Dr. Harry Man* | ,, ,, ,, ,, |
| 1917 | *Crosby, Mrs. do.* | ,, ,, ,, ,, |
| 1912 | [Crowther, Miss Violet] | Shelbrook, Brunstead Road, Westbourne |
| 1916 | Crump, E. Compson | The Hurst, Burton Road, Branksome Park |
| 1916 | Crump, Mrs. | ,, ,, ,, ,, |
| 1913 | Curme, Decimus, Surg. Lt.-Col. | New Bohemia, Nelson Road |
| 1913 | Curme, Mrs. | ,, ,, ,, ,, |
| 1903 | oCurtis, W. Parkinson, F.E.S. | The Square |
| 1914 | Curtis, Eustace H. | Aysgarth, Poole |

# D

| | | |
|---|---|---|
| 1914 | *Dale, Wm., F.S.A. | The Lawn, Archer's Road, Southampton |
| 1910 | de Castro, Geo., M.R.C.S. (Eng.) | Sunnydene, 76, Drummond Road |
| 1910 | de Castro, Mrs. | ,, ,, |
| 1915 | de Castro, Miss Mary B. | ,, ,, |
| 1917 | *Dell, Wm. G.* | 6, Richmond Hill |
| 1905 | de Paiva, R. A. | San Remo, 13, Carysfort Road |
| 1910 | [de Paiva, Mrs.] deceased | |
| 1914 | Dickson, Col. W. D. | Southill, 32, Dean Park Road |
| 1914 | Dickson, Mrs. | ,, ,, |
| 1903o | *Dixon, Dr. J. R. L. | |
| 1910 | Dodshon, Edwin., L.L.B. | Lloyds Bank Chambers |
| 1917 | *Dolamore, F. P.* | Boldrewood, Meyrick Park Crescent |
| 1915 | Dolby, Geo. Alex., F.R.G.S. | Nazdar Hall, Branksome Avenue |
| 1904 | Druitt, J., J.P. | Avebury, 10, Madeira Road |
| 1906 | Dunning, Mrs. | The Homestead, 21, St. Clement's Road |
| 1914 | Dyer, J. Herbert | Hillcrest, Queen's Park West Drive |

# E

| | | |
|---|---|---|
| 1904 | Earle, Dr. | The Wyke, Brunstead Road |
| 1917 | *Edwards, John Rowland* | The Woodlands, 5, Hayes Avenue |
| 1912 | Eiloart, Miss | Glengyle, Chester Road, Branksome Park |
| 1913 | Ellis, Hy. J. | Chesterford, Richmond Park Avenue |
| 1914 | [Else, Miss] | Esterel, 31, West Cliff Road |
| 1904 | Elwes, Captain G. R., J.P. | Bossington, 14, Knyveton Road |
| 1909 | Evans, P. H. L., M.A. | Stirling House, Manor Road |
| 1916 | Evans, Rev. L. H., M.A. | Henbury, New Milton, Hants |

# F

| | | |
|---|---|---|
| 1916 | Farnell-Watson, Mrs. | 15, Alumdale Road |
| 1914 | Fielding, Dr. Thos., M.D. | Halford House, West Hill Road. |
| 1903oA | Firbank, Miss, L.L.A., A.C.P. | 5, Buchanan Avenue |
| 1917 | *Forrest, Mrs.* | Hillsborough, 36, Westbourne Park Road |

| | | |
|---|---|---|
| 1906 | Frean, G. M. | Cranicombe, Branksome Avenue |
| 1910 | Frean, Mrs. | ,, ,, |
| 1915 | Frean, Miss Eleanor | ,, ,, |
| 1913 | Freeman, Miss Emily | Corona, Annerley Road |
| 1915 | Freeman, Geo. Broke | Hasland, 13, Grosvenor Road |
| 1909 | French, J. M. | The Gables, 12, Wharncliffe Road |
| 1911 | [Frewin, Alfred] deceased | Rowherne, 43, Branksome Wood Road |
| 1911 | [Furlong, R. O'B.] C.B., M.A., J.P., deceased | Maesbury, 3, Cavendish Road |
| 1916 | Furner, Miss Kemp | Calluna, 4, West Cliff Road |

## G

| | | |
|---|---|---|
| 1911 | [Gardiner, Miss F. M.] | Heather Cottage, Talbot Hill, Winton |
| 1917 | *Garnett, H. A.* | 18, Campbell Road, Boscombe |
| 1917 | *Garnett, Mrs.* | ,, ,, ,, |
| 1917 | *Garrard, Miss* | The Hawthornes, 67, Richmond Wood Road |
| 1916 | [Gaskell, Miss Edith M.] | St. George's, Darracott Road |
| 1913 | George, Arthur Durancé | Alderholt, 6, Clarendon Road |
| 1914 | AGill, Edwin R., A.R.C.A. | Public Library, Poole |
| 1903 | OGoodall, T. B., F.R.C.V.S., F.L.S | Purewell Cross, Christchurch |
| 1914 | Gosse, Wm., M.D., D.P.H., Camb. | The Links, Sandecotes Road, Parkstone |
| 1916 | Grace, Geo., B.SC., Lond., A.R.C.SC. | Gwynfa, 4, Suffolk Road South |
| 1917 | Grace, Mrs. | ,, ,, ,, |
| 1909 | [Graham, F. A.] | 21, Beaulieu Road |
| 1911 | Grange, W. D'Oyly, M.D. | 11, McKinley Road |
| 1904 | Gray, A. | Woodville, 26, Melville Road, Winton |
| 1911 | Gray, Geo. W. | Darena, 15, Wellington Road |
| 1911 | Gray, Mrs. | ,, ,, |
| 1914 | AGreen, C. B. | Linden Villa, Argyle Road, Swanage |
| 1918 | *Grenfell, Field-Marshal Lord of Kilvie,* G.C.B., G.C.M.G., LL.D., F.S.A. | St. Rode, Parsonage Road |
| 1914 | Greves, E. Hyla, M.D., M.R.C.P. | Rodney House, 19, Poole Road |
| 1914 | Greves, Stanley S. Hyla | ,, ,, |
| 1917 | *Griffiths, Capt. David* | Bakrota, 82, Belle Vue Road, Southbourne |
| 1917 | *Grindley, Miss Edith* | Oakleigh, 2, Bradburne Road |
| 1916 | Grubb, Rev. H. P., M.A. | Surrey Lodge, Balmoral Road, Parkstone |

## H

| | | |
|---|---|---|
| 1914 | Haig, W. S. | Birchwood Cottage, Birchwood Road, Parkstone |
| 1915 | AHall, Chancellor T. C. | Wyngreen, 75, Maxwell Road, Winton |
| 1910 | Hamilton, Mrs. | Boscombe Place |
| 1913 | Hammer, Miss A. G. | 66, Lowther Road |
| 1913 | Hannah, W. Rainsford | Stanmore, 49, Branksome Wood Road |
| 1916 | Hannah, Mrs. | ,, ,, |
| 1908 | AHarding, Miss | Alma Road Council School |
| 1913 | Harris, Miss K. | Trescott Grange, Harvey Road, Boscombe |
| 1912 | Harrison, Henry | Southlea, Durley Road, West Cliff |
| 1914 | Hartley, Dr. J. | 62, Portchester Road |
| 1914 | Hartley, Mrs. | ,, ,, |
| 1914 | Hatton, Rev. C. O. S., B.A. (Camb.) | Hinton Admiral Vicarage, Christchurch |
| 1917A | Hawkins, R. W. | Westlands, Branksome Park |
| 1917 | Haydon, Clement J. | Ben Venta, 29, West Cliff Road |
| 1918 | *Haythorne, Edward Colin Campbell* | Forest Lodge, Burton Road, Branksome Park |

| | | |
|---|---|---|
| 1917 | Henderson, Miss A. J. | 30, Branksome Wood Road |
| 1911 | Henslow, Rev. Professor Geo., M.A., F.L.S., F.G.S. | Danehurst, 40, Branksome Wood Road |
| 1918 | *Elected an Honorary Member | |
| 1905 | [Heywood, Col. J. M.] deceased | Sutherland Hall, South Cliff |
| 1916 | Hill, Rev. Reginald J., M.A. | Cavendish House, 8, Christchurch Road |
| 1909 | Hill, S. McCalmont, D.C.L. | The Club, Boscombe |
| 1904 | Hinton, Miss | Welcombe, 1, Argyll Road, Boscombe |
| 1913 | [Hippisley-Smith, Rev. A.] | Knowlton House, 22, Surrey Road |
| 1917 | *Hobson, Miss* | The Hawthornes, 67, Richmond Wood Road |
| 1917 | *Holdom, Mrs.* | Cranfield, Spurr Hill avenue, Parkstone |
| 1916 | Holgate, Mrs. | 63, Paisley Road, W. Southbourne |
| 1910 | Holmes, C. F. | Brackenwood, 37, Southern Road, West Southbourne |
| 1909 | Holmes, Mrs. | ,, ,, ,, |
| 1911 | Holmes, Miss M. A. | 4, Beaufort Road, West Southbourne |
| 1911 | Holmes, Miss S. C. M. | ,, ,, |
| 1911 | Homer, L. V. C. | Carron, 54, Southcote Road |
| 1911 | Honeyman, G. | Stormont, Milton Road |
| 1912 | Honeyman, Mrs. | ,, ,, |
| 1912 | Honeyman, Miss M. W. | ,, ,, |
| 1918 | Hood, Mrs. Alfred | Loughtonhurst, West Cliff Gardens |
| 1911 | Hudson, F. | Peñarol, Parkstone |
| 1911 | Hudson, Mrs. | ,, ,, |
| 1917 | Hume, Dr. Geo. H. | Lawnswood, Beechey Road |
| 1916 | [Humphreys, Mrs.] | Danebury, Twynham Road, Southbourne |
| 1917 | Hussey, Chas. | 18, Grand Avenue, W. Southbourne |

## I

| | | |
|---|---|---|
| 1905 | Ibbett, F. W., M.A. | Central Education Office, Yelverton Road |
| 1914 | Instone, Thos. | 31, Portchester Road |
| 1914 | Instone, Mrs. | ,, ,, |
| 1914 | Instone, Allan C. | ,, ,, |
| 1914 | Instone, Mrs. A. C. | ,, ,, |

## J

| | | |
|---|---|---|
| 1912 | James, Thos. Bath | Trevenen, Howard Road |
| 1912 | James, Mrs. | ,, ,, |
| 1912 | James, Miss G. Gladys | ,, ,, |
| 1911 | Jeffery, T. J. P. | Meldon, Ormonde Road |
| 1911 | Jeffery, Miss Ruby | ,, ,, |
| 1912 | Jeffery, Miss E. S. M. | Boscombe Grange, Percy Road |
| 1917 | *Jermyn, F. L.* | Continental Hotel |
| 1916 | Jones, Miss M. | 10, St. Stephen's Road |
| 1917 | [Jones, Mrs. Tudor] | The Cottage, King's Avenue, Parkstone |
| 1908 | AJones, W. | Council School, Boscombe |
| 1905 | Jones, W. | 254, Old Christchurch Road |

## K

| | | |
|---|---|---|
| 1910 | Kay, A. J. | Winsgarth, 141, Lowther Road |
| 1911 | Kaye, J. E. | Tynedale, 38, Portchester Road |
| 1911 | Keevil, W. C. | Eglington, Kinson, Bournemouth |
| 1917 | *Kelsall, Rev. J. E., M.A. | Milton Rectory, New Milton, Hants |
| 1914 | Kenrick, Archibald | Broom House, 37, West Cliff Road |
| 1914 | [Kenrick, Miss M.] | ,, ,, |
| 1912 | Keogh, Duncan | The Warren, 13, Richmond Wood Road |
| 1912 | Keogh, Mrs. | ,, ,, |
| 1916 | Kersey, H. A. | 166, Old Christchurch Road |
| 1917 | Kidner, Hy., F.G.S. | Broomhill House, Burley, Ringwood |

| | | |
|---|---|---|
| 1913 | Killick, H. F. | Rawdon, 9, Marlborough Road |
| 1916 | Kilner, Miss Ethel M. | The Cottage, 33, Hawkwood Road |
| 1912 | Kirkby, Mrs. | Inglewood, Richmond Park Avenue |
| 1918 | *Kohn, Arthur L.* | Loughrigg, 31, Nelson Road |

## L

| | | |
|---|---|---|
| 1917 | *Langley, Miss Constance* | 96, Richmond Wood Road |
| 1910 | Lattey, F. | Alyngby, 44, Stourcliffe Avenue, Stourwood |
| 1917 | *Lattey, Mrs.* | ,, ,, ,, |
| 1906 | [Le Jeune, Hy.] deceased | 55, Ashley Road, Upper Parkstone |
| 1917* | Elected an Honorary Member | |
| 1910 | Lendrum, Miss A. M. | c/o Mr. de Paiva |
| 1913 | Letcher, Mark Jameson | Gwestfa, 18, Richmond Wood Road |
| 1917 | Leverson, Montague, Rd., M.D., M.A. | 79, Irving Road, W. Southbourne |
| 1913 | [Lewis, Miss Constance F.] | 6, St. John's Avenue, Boscombe |
| 1917 | *Ley, Dr. Hy. Jas.* | 62, Herberton Road, W. Southbourne |
| 1917 | *Ley, Mrs.* | ,, ,, ,, |
| 1905 | *Liddiard, Jas. E., F.R.G.S., M.N.G.S. (U.S.A.) | Rodborough Grange, 66, West Cliff Road |
| 1903o | *Linton, Rev. E. F., M.A., F.L.S. | Edmondsham, Salisbury |
| 1916 | Littlejohns, Eng. Rear-Admiral, C.B. | Harrow, Forest Road, Branksome Park |
| 1916 | Logan, Mrs. | 36, Hamilton Road |
| 1909 | Lucas, Arthur | Croftmoor, 23, Dean Park Road |
| 1903 | oLupton, Miss | Bolingbroke, Knole Road |
| 1909 | Lyon, Claude | Shalimar, Wilderton Road, Branksome Park |
| 1909 | Lyon, Mrs. | ,, ,, ,, |
| 1911 | Lynch-Blosse, Rev. R. C., M.A. | Hawthorne Dene, 10, Cavendish Road |
| 1911 | Lynch-Blosse, Mrs. | ,, ,, ,, ,, |

## M

| | | |
|---|---|---|
| 1911 | Macalister, R., M.INST.C.E. | Somerled, 29, Meyrick Park Crescent |
| 1911 | Macalister, Mrs. | ,, ,, |
| 1916 | [MacDougall, Geo. Rogers] deceased | Bracken Coombe, 30, Branksome Wood Road |
| 1908 | AMackay, Miss | St. Andrew's School, Malmesbury Park |
| 1912 | [Mackelvie, J. McIntosh] | Cliff Cottage, Boscombe Manor Park |
| 1912 | [Mackelvie, Mrs.] | ,, ,, |
| 1912 | [Mackelvie, Miss Esther H.] | ,, ,, |
| 1912 | [Mackelvie, Miss Doris] | ,, ,, |
| 1913 | Mackenzie, Ridley, M.D. | Heather Bank, Richmond Hill |
| 1911 | McBean, Miss J. | Inglenook, 29, Parkwood Road |
| 1909 | AMcBean, Miss S. | Froebelheim School, 47, Lowther Road |
| 1918 | *McLaughlin, Fredk. Jas., M.Inst.C.E.* | 2, Alexandra Road, W. Southbourne |
| 1918 | *Malim, Herbert,* M.A. | 4, Lorne Park |
| 1917 | *Manera, Lieut.-Col. G.* | 18, St. Swithun's Road |
| 1910 | Mann, W. P., B.A. | 38, Crabton Close Road |
| 1905 | *Markwick, Col. E. E., C.B., F.R.A.S. | Headquarters, Irish Command, Park Gate, Dublin |
| 1917 | Marston, Miss G. | Hawthorns Hotel |
| 1913 | Martin, Miss Florence G. | 32, Southbourne Road |
| 1911 | Martland, Dr. T., L.R.C.P., M.R.C.S. | Standish House, Fitzharris Avenue |
| 1916 | Mason, Rev. A. L. A., M.A. | Alington Grange, 9, Kerly Road |
| 1906 | Mate, Ald. C. H., J.P. | Elim, 3, Surrey Road South |
| 1914 | Mate, Sidney J. | 10, Landseer Road |
| 1916 | [Mather, Alfred] | Elstead, 8, Knyveton Road |
| 1916 | [Mather, Mrs.] | ,, ,, ,, |

| | | |
|---|---|---|
| 1912 | Maybery, Joseph, J.P. | Langley Dene, 55, Wellington Road |
| 1918 | *Mettam, Mrs. Wilford* | 12, Crabton Close Road |
| 1911 | Michell, Mrs. | Merton, 54, Christchurch Road |
| 1916 | [Middleton, Mrs.] | Birdlip, 44, Lansdowne Road |
| 1913 | Moore, F. W. | Goathland, Tower Road, Branksome Park |
| 1908 | †*Morris, Sir Daniel, K.C.M.G., J.P., M.A., F.L.S. | 14, Crabton Close Road |
| 1911 | Morris, Lady | ,, ,, |
| 1908 | Moss, Miss | The Grange, 52, Westby Road |
| 1915 | Muncaster-Jones, Thos. | Hillingdon, Brunstead Road |
| 1915 | Muncaster-Jones, Mrs. | ,, ,, |
| 1915 | Muncaster-Jones, Miss | ,, ,, |

## N

| | | |
|---|---|---|
| 1903 | oNeale, J., B.A. | Clonenagh, Montagu Rd., W. Southbourne |
| 1910 | Neale, Mrs. | ,, ,, ,, |
| 1910 | Neale, Miss D. | ,, ,, ,, |
| 1912 | Neave, Mrs. | Lingdale, 73, Lansdowne Road |
| 1912 | Neave, Miss | ,, ,, |
| 1905 | Neve, Miss G. | The Haven, Sea Road, Boscombe |
| 1914 | Nicholl, G. B. T., J.P. | Santos, Capstone Road |
| 1914 | Norton, John J. | Ashton Court, Branksome Park |
| 1914 | Norton, Mrs. | ,, ,, |

## O

| | | |
|---|---|---|
| 1917 | Odlum, Walter Edwd. | Savoy Hotel, Bournemouth |
| 1917 | Odlum, Mrs. | ,, ,, ,, |
| 1917 | Odlum, Miss Doris Maude, B.A. | ,, ,, ,, |
| 1910 | Oke, A. W., B.A., LL.M., F.G.S., F.S.A. | 32, Denmark Villas, Hove, Brighton |
| 1913 | Oliver, Mrs. E. | Teviotdale, Milton Road |
| 1903 | oOrd, Dr. W. T., F.G.S. | Bramber, 18, Littledown Road |

## P

| | | |
|---|---|---|
| 1911 | [Pain, Miss M. T.] | Membury, 52, Wellington Road |
| 1903 | oPainter, Hubert, B.SC., F.C.S. | 29, Talbot Road, Winton |
| 1904 | Painter, Mrs. | ,, ,, |
| 1910 | Pate, Rev. J. | Spencer House, Constitution Hill, Parkstone |
| 1909 | Pechell, Sir A Brooke, Bart. | c/o Messrs. Holt and Co., 3, Whitehall Place, S.W. |
| 1915 | Penrose, Dr. Francis Geo., M.D., F.R.C.P., F.Z.S., M.B.O.U. | Hawkley, 27, West Cliff Road |
| 1916 | Penrose, Mrs. | ,, ,, |
| 1916 | Penrose, Miss Frances | ,, ,, |
| 1916 | Penrose, Miss Marcia | ,, ,, |
| 1917 | Pepworth, W. H. | Stratton, Morley Road |
| 1912 | Pestell, Miss | Engelberg, Surrey Road |
| 1911 | Phillips, Mrs. | 43, Alumhurst Road |
| 1912 | Philpott, Mrs. | c/o Miss Cheere, 58, Barkston Gardens, S. Kensington, S.W.5 |
| 1914 | Pollock, Mrs. | 43, Wellington Road |
| 1909 | APovah, Edwin | 68, Parkwood Road |
| 1914 | Powell, M. | Edenhope, Chessel Avenue, Boscombe Manor |
| 1909 | Preston, Donald W. | Bank Chambers, Yelverton Road |
| 1916 | Preston, G. A. | Chalfont, 44, Belle Vue Rd., Southbourne |
| 1912 | Price, Miss Annie N. | Shelford Lodge, 19, Grand Avenue, West Southbourne |
| 1911 | Pullman, A. | Seacroft, Cliff Drive, Southbourne |

## R

| | | |
|---|---|---|
| 1915 | ARainer, A. J. | 6, King's Park Road |
| 1916 | [Rainier, Mrs. P.] | Gardenhurst, Queen's Park Road |
| 1915 | [ARalph, E. W.] | Berwood, Spring Road |
| 1915 | Ramsay, Miss | Redroofs, Ipswich Road |
| 1912 | Rankin, W. Munn, M.SC. (Leeds), B.SC. (Lond.) | Municipal College, Lansdowne |
| 1916 | Rankin, Mrs. Munn | Stoneleigh, Heron Court Road |
| 1917 | *Ranshaw, Miss E. M.* | 9, Warren Road |
| 1904 | †Ransome, Dr. A., M.A., F.R.C.P., F.R.S. | Sunnyhurst, 7, Dean Park Road |
| 1918 | *Elected an Honorary Member | |
| 1905 | *Rayner, J. F., F.R.H.S. | Swaythling, Southampton |
| 1918 | *Richards, Miss Elsie E.* B.SC. (Lond.) | Felsted, 40, Tregonwell Road |
| 1914 | [Ritson, Mrs.] | Plas Pinwydd, 2, Durrant Road |
| 1916 | Roberts, Hy. Astley, B.A. (Lond.) | Shalvah, Wilfred Road, Boscombe Manor |
| 1916 | Roberts, P. E., J.P. | Northover, Dunbar Road, Talbot Woods |
| 1916 | Roberts, Mrs. | ,, ,, ,, ,, ,, |
| 1916 | Roberts, Miss | ,, ,, ,, ,, ,, |
| 1915 | Roberts, Rev. V. C., B.A. | 41, Parkwood Road |
| 1910 | Robertson, Mrs. | Struan, Alum Chine Road |
| 1916 | [Robinson, Miss A. M.] | Armadale, Balmoral Road, Parkstone |
| 1916 | [Rogers, Hy.] | 10, Inverleith Terrace, Edinburgh |
| 1910 | *Rogers, Rev. Moyle | Chetnole, 11, Grosvenor Road |
| 1905 | Rogers-Barns, Miss | Bevois Cottage, 25, King's Park Road |
| 1914 | Rooke, Miss S. G. | Norbury, 53, Paisley Road |
| 1903 | oRooper, Miss C. Agnes | Pen Selwood, 13, Gervis Road |
| 1914 | *Roper, Miss Ida M., F.L.S. | 4, Woodfield Road, Redland, Bristol |
| 1911 | Ross, Rev. T. S. | Lennox, 16, Foxholes Road, Southbourne |
| 1907 | Ross, Col. W. H. | Ambleside, 9, Dean Park Road |
| 1916 | Rothwell, Mrs. | Whytton, Penn Hill Avenue, Parkstone |
| 1913 | [Rowe, Mrs. R. Vidal] | Viwa, 9, McKinley Road |
| 1905 | Rudkin, Miss F. | Ivel Cottage, 25, Hamilton Road, Boscombe |
| 1912 | [Rumsby, Mrs.] | Ennisfall, Fitzharris Avenue, Charminster Park |
| 1916 | [Russell, Mrs.] | Woodheath, 21, Knyveton Road |
| 1906 | Russell-Wright, Rev. T., M.A. | 92, Richmond Park Road |
| 1912 | Rutherfurd, R. C. | South Dene, 1, Groveley Road |
| 1910 | Rutter, G. H., M.B. | Roxbury House, 22, Poole Road |
| 1916 | Ryley, S., Clement | The Square, Wimborne |

## S

| | | |
|---|---|---|
| 1910 | ASaunders, Hugh A., B.A., F.R.G.S. | Brookfield House, Swanage |
| 1913 | Saunders, Miss L. Metta | Pine Cottage, Chester Road, Branksome Park |
| 1917 | *Saunders, Mrs.* | c/o Dr. Ley, 62, Herberton Road, West Southbourne |
| 1912 | Scarlett, Miss A. | Fermoy, St. Alban's Avenue |
| 1912 | Scarlett, Miss K. | ,, ,, |
| 1912 | Scarlett, Miss M. | ,, ,, |
| 1908 | AScattergood, J. | Alma Road Council School |
| 1914 | Scholes, Denton | Craigmoor, 7, Branksome Wood Road |
| 1915 | Scholes, Mrs. | ,, ,, |
| 1904 | Scott, J. H., M.E., M.I.M.C.E. | Kirkby, Linwood Road, Charminster Park |
| 1905 | Scott, W. H., M.A. | Hendall, Westminster Road |
| 1916 | ASeeviour, G. C., A.C.P., F.R.H.S. | St. Peter's School House |
| 1914 | Sharp, Chas. | Milfield, Langdon Road, Parkstone |

| | | |
|---|---|---|
| 1903 | oSherring, R. V., F.L.S. | Hallatrow, near Bristol |
| 1907 | Sherring, Miss O. L. | ,, ,, |
| 1914 | Sidgwick, Chas. | Lindsay House, Lindsay Road, Branksome |
| 1914 | Sidgwick, Mrs. C. | ,, ,, ,, |
| 1915 | Simcox, Miss Winifred | 75, Walpole Road |
| 1916 | Simpson, Rev. E. J. Douglas, M.A. | Carlton Miniott, 8, Wellington Road |
| 1918 | *Smith, Miss Mary A.* | Woodside, St. Alban's Crescent |
| 1917 | *Smith, Percy* | The Club, Bournemouth |
| 1914 | Smyth, Dr. W. Johnson, M.D. (Edin.) | Pirbright, West Cliff Gardens |
| 1912 | Smythe, J. H. Ralph, J.P. | Willstead, 22, Cavendish Road |
| 1915 | Smythe, Mrs. | ,, ,, |
| 1916 | Smythe, Miss Kathleen Mary | ,, ,, |
| 1912 | Solly, Rev. Hy. Shaen, M.A. | Southcote, 76, Alexandra Road, Parkstone |
| 1917 | *Spencer, F. M.* | 22 St. Winifred's Road |
| 1909 | Spencer, J. F. | Glenthorne, 73, Richmond Park Road |
| 1917 | ASpry, Miss Alice G., LL.A. | 60, Fitzharris Avenue |
| 1918 | *Standen, A. W.* | 27, Methuen Road |
| 1917 | Stell, Miss Emily | Gwynfa, 4, Suffolk Road South |
| 1916 | Stiff, Sydney Jas., B.SC. | Nordon House, Corfe Castle |
| 1916 | Stiff, Mrs. F. L. | ,, ,, |
| 1916 | Stiff, Miss F. A. | ,, ,, |
| 1908 | Stokes, R. | Laverstock, Cliff Road, Boscombe |
| 1918 | *Stuart, Col. J. F.*, R.N. | Chester House, Chine Crescent |
| 1911 | Swain, H. E. | Sorrento, Studland Road |
| 1906 | Swallow, E. | Westridge, Sandbanks, Parkstone |
| 1916 | Swayne, Francis Thos. | 24, Stourcliffe Avenue, W. Southbourne |
| 1916 | Swinney, A. J. G., M.E., M.INST.M. AND M. | 117, Richmond Park Road |
| 1905 | Sworn, Mrs. | Normandale, 63, Lansdowne Road |
| 1913 | Sykes, Mrs. | Oak Lodge, Talbot Avenue |
| 1913 | Sykes, Miss | ,, ,, |

## T

| | | |
|---|---|---|
| 1916 | Tarr, Miss M. K. | Sandsfoot, Chester Road, Branksome Park |
| 1911 | Tatchell, Leonard | 23, Arcade |
| 1915 | Taylor, F. B., B.A. | Thurgarton, 55, Grand Avenue |
| 1916 | Taylor, Mrs. | ,, ,, |
| 1916 | Taylor, Miss Mary Angela | ,, ,, |
| 1916 | Taylor, Miss Mary Winifride | ,, ,, |
| 1915 | Taylor, Jas. | 61, Lansdowne Road |
| 1917 | *Thickett, Mrs. J. W.* | 22, Hamilton Road |
| 1912 | [Thomas, J] | c/o Bright's Stores |
| 1903o | [Thomson, Dr. J. Roberts] M.D., F.R.C.P., J.P., deceased | Monkchester, 17, Manor Road |
| 1911 | Thomson, Mrs. | ,, ,, |
| 1911 | [Thomson, Matthew] | Fircliff, 29, Studland Road |
| 1916 | Thoroton, Rev. L .E. W. | Hill House, Canford Cliffs |
| 1911 | Tickell, Miss S. M. | Pinewood, 56, Stourcliffe Avenue, West Southbourne |
| 1916 | Tottenham, Chas. Edwd. | Athelstan, Queen's Park Road |
| 1911 | Towsey, Miss E. L. | Moseley, 20, Owls Road, Boscombe |
| 1911 | Turner, J. E. | Bramley, Surrey Road |
| 1914 | Twemlow, Miss Emily E. | Devon Lodge, 83, Alumhurst Road |

## U

| | | |
|---|---|---|
| 1912 | Usherwood, Rev. Canon T. E., M.A. | Bagdale, Parkstone |

# V

| | | |
|---|---|---|
| 1913 | Veale, Miss Alice G. | Fairdale, Howard Road |
| 1910 | Veale, Miss L. H. | ,, ,, ,, |
| 1910 | Veale, Miss Mary Christina | ,, ,, ,, |
| 1912 | Veale, Miss Bertha | Lexden, 15, Richmond Wood Road |
| 1917 | Veale, Miss Clara M. | ,, ,, ,, ,, |
| 1908 | Vernon, Major A. H., L.R.C.P., F.R.C.S. | 1, Carnarvon Crescent, Boscombe |
| 1909 | Vipan, Miss Dora | 5, McKinley Road |

# W

| | | |
|---|---|---|
| 1903 | o†Waddington, H. J., F.L.S. | Moreton, 107, Lowther Road |
| 1918 | *Elected an Honorary Member | |
| 1916 | Walby, Arthur Edwd. | Netherton, 2, Dean Park Road |
| 1911 | [Waldron, Miss F.] | Benvenuto, 15, Portarlington Road |
| 1918 | *Walker, Robt. S.* | Ellesborough, Ormonde Road, Branksome Park |
| 1918 | *Walker, Mrs.* | ,, ,, ,, ,, |
| 1918 | *Walker, C. B. Osborn* | ,, ,, ,, ,, |
| 1918 | *Walker, Miss G. M.* | ,, ,, ,, ,, |
| 1913 | Wallace, Wm. G. | Ashley Chambers, Ashley Road, Boscombe |
| 1912 | Walter, Mrs. G. P. | Rusholme, 10, St. Anthony's Road |
| 1916 | [Warmington, Rev. Edwd. J.] M.A. | Manoa, 5, Clarendon Road |
| 1916 | [Warmington, Miss Dorothy M.] | ,, ,, |
| 1909 | Warr, Miss Ada | Cottesmore, Pokesdown Hill |
| 1905 | Waters, A. W., F.L.S., F.G.S. | Alderley, 2, McKinley Road |
| 1906 | Waters, Mrs. | ,, ,, |
| 1912 | Watts, Col. Sir Wm., K.C.B. | The Priory, 53, Branksome Wood Road |
| 1914 | Webber, A. E. | 28, Tower Road, Boscombe |
| 1909 | Webster, Rev. T. | Devonia, 2, Chatsworth Road |
| 1917 | *Webster, Mrs.* | ,, ,, |
| 1906 | Wells, H. B. | Stalham, 16, Studland Road |
| 1913 | Wetherell, Miss | Triana, 21, Harvey Road, Boscombe |
| 1911 | Whiting, Albert | Rozel, 7, Pinecliffe Avenue, West Southbourne |
| 1916 | Whyte, A. C. | Byberry, Roslin Road |
| 1916 | Whyte, Mrs. | ,, ,, |
| 1916 | Whyte, Miss Mina C. | ,, ,, |
| 1916 | Whyte, Miss Mary N. | ,, ,, |
| 1913 | Willes, W. A. | Elmwood, Cranborne Road |
| 1915 | Williams, Dr. C. E. Campbell | Greystones, Marlborough Road, Canford Cliffs |
| 1915 | Williams, Mrs. | ,, ,, ,, ,, |
| 1917 | *Williams, Hy.*, M.V.O., I.S.O. | Kinfauns, St. John's Road, Branksome |
| 1917 | *Wingfield, T. R.* | 12, Suffolk Road |
| 1914 | Wood, W. H. | Arosa, Tower Road, Branksome Park |
| 1916 | Wood, Mrs. | ,, ,, ,, |
| 1916 | AWoodhead, Miss G. R., B.SC. | High School, Norwich Avenue |
| 1905 | Woodhouse, W. J., A.C.P. | 35, Chatsworth Road, Malmesbury Park |
| 1914 | AWoodhouse, Wm. | Attleborough, 34, Wimborne Road |
| 1917 | Woodward, Chas. H., A.M.I.E.E. | Kenistone, Richmond Park Crescent |
| 1909 | Woollacott, J. C. | Solent View, Belle Vue Road, Southbourne |

# Y

| | | |
|---|---|---|
| 1908 | Yates, R. P. | Woodmanton, 35, Wellington Road |
| 1918 | *Young, Andrew Aytoun* | 35a, Branksome Wood Road |
| 1918 | *Young, Mrs.* | ,, ,, |
| 1917 | AYoung, Miss Annie | 6, Salisbury Road, Boscombe |

BRITISH MUSEUM NATURAL HISTORY

SECOND-LIEUT. MONTAGU MOORE, V.C.

# On His Majesty's Service.

Although the members of the Society are, for the most part, disqualified by age or sex from active participation in the war, many have sons and other near relatives either now serving in His Majesty's Naval or Military Forces or having made the last sacrifice. The brief lists which follow, however, only include the names of those who are, or have been, themselves members of the Society.

## On Active Service.

### SECOND-LIEUT. MONTAGU SHADWORTH SEYMOUR MOORE, V.C.

From his earliest days, Monty Moore, as he is called by his friends, has been interested in Natural History, especially in ornithology and entomology. He soon made himself acquainted with the habitats and forms of birds and with the larvæ and imagines of the Lepidoptera of the district. Through the kindness of Mr. H. B. Wells, formerly Chairman of the Microscopical and Zoological Sections, he learnt a good deal about the microscope and the mounting of specimens. At one time, when he contemplated going in for Economic Entomology as a profession, he showed some of his mounted specimens to Professor Maxwell-Lefroy, at South Kensington, who was much pleased with them. He went to Sandhurst in January, 1916, and joined the Hampshire Regt. in France in the following September. He was on the Somme for a short time, at Hollebeke, at St. Eloi (where he was wounded in June, 1917), and at "Tower Hamlets." He earned the V.C. September 20th, 1917, and has also been awarded the Croix de Guerre by the French.

The following extract from a supplement to "The London Gazette," dated November 8th, 1917, gives the official account of the conduct which won the V.C. :—

War Office,
8th November, 1917.

His Majesty the King has been graciously pleased to approve of the award of the Victoria Cross to the undermentioned . . .

2nd-Lt. Montagu Shadworth Seymour Moore, Hamp. R. For most conspicuous bravery in operations necessitating a fresh attack on a final objective which had not been captured.

2nd-Lt. Moore at once volunteered for this duty and dashed forward at the head of some 70 men. They were met with heavy machine gun fire from a flank, which caused severe casualties, with the result that he arrived at his objective—some 500 yards on—with only a Sergeant and four men. Nothing daunted he at once bombed a large dug-out and took twenty-eight prisoners, two machine guns and a light field gun.

Gradually more officers and men arrived, to the number of about 60. His position was entirely isolated as the troops on the right had not advanced, but he dug a trench and repelled bombing attacks throughout the night. The next morning he was forced to retire a short distance. When opportunity offered he at once re-occupied his position, re-armed his men with enemy rifles and bombs, most of theirs being smashed, and beat off more than one counter-attack.

2nd.-Lt. Moore held this post under continual shell fire for thirty-six hours until his force was reduced to ten men, out of six officers and 130 men who had started the operation. He eventually got away his wounded, and withdrew under cover of a thick mist.

As an example of dashing gallantry and cool determination this young officer's exploit would be difficult to surpass."

### SUB-LIEUT. EDWARD WILLIAM BARLOW, R.N.V.R.

Mr. Barlow, B.Sc., F.R.A.S., has been a member of the Society since 1905. He is a former Chairman of the Photographic and Secretary of the Physical Section, and has given several lectures before both sections. It is believed that his scientific training and knowledge are proving very useful in his present position.

### PRIVATE DOUGLAS BENNETT, H.A.C.

Mr. D. Bennett, B.A. (Cantab.), was elected a member of the Society in 1917.

### PRIVATE JOSEPH OMER COOPER.

Mr. J. O. Cooper joined the Society in 1909. He is a keen student of Natural History and, as Secretary of the Zoological and Microscopical Sections, did much useful work. He read a paper before the Entomological Section on December 10th, 1915.

## Roll of Honour.

SECOND-LIEUT. ROBERT LONGBOTTOM,
King's Royal Rifle Corps.
Killed in action at Hooge, July 30th, 1915.

ENSIGN JOHN KIPLING, Irish Guards.
Killed in action at Loos, September 16th, 1915.

PRIVATE WILFRID OMER COOPER, Royal Fusiliers.
Killed in action, September 26th, 1916.

CAPTAIN GERALD HENRY SULIVAN, Royal Marines.
Killed in action, November 13th, 1916.

NOTE.—Mr. R. Longbottom and Mr. J. Kipling were elected members of the Society in 1913. The latter was the son of Mr. Rudyard Kipling. An " Appreciation " of W. O. Cooper will be found in Volume VIII., page 71, and a reference to Capt. Sulivan in the same Volume, page 70.

# RULES OF THE
# Bournemouth Natural Science Society.

*Amended October, 1917.*

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Title

1.—The title of the Society shall be THE BOURNEMOUTH NATURAL SCIENCE SOCIETY.

Objects

2.—The objects of the Society shall be the promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, and the formation of Sections of its members devoted to any particular branch of the Society's work, or by any other means that the governing body of the Society shall deem advisable.

3.—The Society shall encourage the making of reports on any plant, animal, or object of interest, and where the Society may deem it necessary, shall take such steps as may be advisable to secure any such plant, animal, or object of interest from injury, extinction or destruction.

Members

4.—The Society shall consist of Ordinary, Life, Associate, and Honorary Members.

Council

5.—There shall be a Council of the Society consisting of the Hon. Treasurer, one or more Secretaries, Honorary or otherwise, the Vice-Presidents who have filled the office of President, the Hon. Librarian, the Hon. Editor, the Hon. Curator, the Chairmen of Sections and twelve elected Members.

The Council shall have the general management of the Society. At all Meetings of the Council, five shall form a Quorum. The Council shall elect their own Chairman and Deputy-Chairman for the Year, and shall have power to fill up any vacancies in their number which may occur from time to time. The Council shall have power to appoint Committees to deal with any business that may be delegated to them.

The Chairman, or in his absence the Deputy Chairman, at all Meetings of the Council shall have an original and a casting vote.

The Council shall have the control of the Funds of the Society.

Executive Officers

6.—The Executive Officers of the Society shall consist of the Chairman and Deputy Chairman of Council, Hon. Treasurer, and one or more Secretaries, Honorary or otherwise.

7.—The Ordinary, Life, and Associate Members of the Society shall be proposed by an existing Member, and seconded by another existing Member, and notice shall be sent to one of the Secretaries of the Society of the names and address of the nominee, and the names of the proposer and seconder. Any such proposed new Member shall be voted for at the next ensuing Council Meeting, and if two-thirds of the Council present and voting shall vote for the proposed new member, such candidate shall become a Member upon payment of the Annual Subscription, and shall receive a card of membership (not transferable) entitling him or her to attend the Meetings of the Society. Members joining during August and September shall be given a card of membership to September 30th of the following year.

Ordinary Members.

8.—Ordinary Members shall pay an Annual Subscription of Ten Shillings, due on the first day of October in each Year. The Annual Subscription for Adult Members of the same family, not exceeding four and residing in the same house, shall be Twenty Shillings, each Member being elected in the usual manner and each receiving a card of membership.

Life Members

9.—The Subscription for Life Members shall be Five Guineas. Any Ordinary Member who shall have commuted his Subscription, as provided for in this Rule, shall become a Life Member, but shall not by reason thereof have any different rights from those of an Ordinary Member.

Associate Members.

10.—Associate Members are those who by payment of an Annual Subscription of Two Shillings and Sixpence are entitled to attend all the General Meetings and Excursions of the Society. They also have the privilege of attending the Meetings and Excursions of one particular Section they may select at the time of their Election, or at the commencement of each Session, their choice being notified by them to the Hon. Treasurer. The following are entitled to become Associate Members on Election by the Council:—

(a) Teachers in schools who are still engaged in the active duties of their profession.

(b) Persons, who in the opinion of the Council, although unable to pay the fee for full membership, are by their acknowledged scientific tastes or attainments, likely to prove useful working Members of the Society.

On further payment of Two Shillings and Sixpence Associate Members are admitted to the Meetings and Excursions of all the Sections.

Associate Members shall have no power of voting on the affairs of the Society, or of holding office.

Honorary Members

11.—Any person who is either distinguished in Science or has rendered any special service to the Society, may be elected an Hon. Member. Such Hon. Members shall be proposed and elected in the same way as Ordinary Members.

Visitors

12.—Any Visitors introduced by a Member or producing a Member's card, may be admitted to any Meeting or Excursion of the Society on entering their names and that of the introducing Member in the Society's Visitors' Book. Such privilege not to be granted more than twice to any one person in each Session.

On the recommendation of the Council or Committee authorised by it, Visitors to Bournemouth desirous of attending the Meetings or Excursions of the Society, may obtain a ticket of admission for the Winter or the Summer Meetings or Excursions at a charge of Seven Shillings and Sixpence. Application to be made to the Hon. Secretary for submission to the Council or Committee authorised by it.

13.—Any Members whose subscriptions are unpaid at the end of the financial year (September 30th), on notice to that effect in writing having been given to them by the Hon. Treasurer, shall be reported to the Council, who shall have the power of removing their names from the list of members.

14.—Resignations should be in writing, and addressed to one of the Hon. Secretaries, and until such are received by them, Members remain liable for their subscriptions.

15.—The power of expulsion of a Member from the Society for objectionable conduct shall be vested in a General Meeting of the Society, provided the Council has caused special notice to be given on the circular convening the Meeting, and that two-thirds of those present and voting agree thereto.

16.—The Council shall arrange all Lectures, Papers, Demonstrations and Exhibitions of Specimens, etc., both for the General and Sectional Meetings of the Society, and shall decide upon all General and Sectional Excursions.

Sections.

17.—The Council shall have power to form any Section or Sub-Section, to consist of not less than six Members, for the study of any special subject which the Council may deem within the scope of the Society's work. They shall annually appoint the Chairman of any such Section or Sub-Section on the nomination of that Section or Sub-Section.

A Section shall consist of those Members who attend in each year not less than three meetings of such Section.

The Chairman of each Section shall appoint a Secretary, who in addition to the ordinary secretarial duties shall keep a list of the Members of the Section.

Sectional Meetings.

18.—Each Sectional Chairman shall be responsible for the preparation and arrangement of each Sectional Meeting and Excursion, and shall submit details of the same to the Hon. Secretary for submission to the next ensuing Meeting of the Council. He shall submit accounts of costs incurred by him to the Hon. Treasurer, after each Meeting or Excursion, who shall lay the same before the Council at their next ensuing Meeting. At the first Meeting of each Section or Sub-Section in the Year, after the Annual Meeting, such Section or Sub-Section shall nominate its Chairman.

19.—A book for each Section shall be provided by the Secretaries to be kept at the Society's Room; each Chairman of Section, or his Secretary shall enter therein an account of each Meeting, with number of Members attending, and notes of any matters of interest observed or discussed. Such book to be presented at each Meeting of the Council. Every Chairman of Section shall report at each Meeting of the Council. Every Chairman of Section shall report as to the work of his section at the Annual Meeting of the Society.

20.—Any Members of the Council other than Ex-officio Members who shall have failed to attend half the Meetings of the Council held in any one year, provided that such non-attendance be not caused by illness or absence abroad, shall not be eligible for re-election, except by desire of the Members present at the Annual Meeting.

The President

21.—The President need not necessarily be selected from Members of the Society, and shall be elected annually. He shall deliver an Address at as early a date in the Winter Session as can be arranged.

Vice-Presidents

22.—Any Member of the Society who, in the opinion of the Council, shall have rendered distinguished service to Science or to the Society, shall be eligible for election as a Vice-President at the Annual Meeting, as long as he or she remains a Member of the Society.

23.—Each of the Vice-Presidents in rotation shall be requested to act as Chairman at the General Meetings of the Society.

Secretaries.

24.—The Secretaries shall perform all the usual secretarial work; shall keep minutes of all Council Meetings, and the Annual Meeting, and a synopsis of all General Meetings. They shall cause a programme of each General Meeting to be sent to every Member seven days at least before each such Meeting. They shall make all preparations for carrying out all General Meetings and General Excursions, at which they shall receive from each Member his or her share of the day's expenses, and therefrom defray all costs of the Meeting. Any surplus of such collection shall go to the General Fund, and any deficit be defrayed out of that fund. They shall keep an account of all out-of-pocket expenses incurred in arranging Meetings and otherwise. They shall give notice of their election to all new members, they shall furnish a copy of the Annual Report to all Members who have paid their subscription, to Honorary Members, and to any such Scientific Societies as the Council may from time to time appoint to receive them.

Treasurer

25.—The Honorary Treasurer shall have the custody of the General Funds of the Society. He shall prepare a Financial Statement at the end of each Financial Year to be presented to the Council at the Meeting next preceding the Annual Meeting. He shall receive and acknowledge all Subscriptions, and shall issue tickets of Membership to all persons who are duly elected and have paid their Subscriptions. He shall bring before the Council any accounts that are due for payment. After presentation of the Balance Sheet to the Council, he shall submit it to the Auditors and lastly to the Annual Meeting of the Society.

26.—At the Annual Meeting and at all General Meetings of the Society, not less than ten Members shall form a quorum.

Annual Meeting

27.—At the Annual Meeting, which shall be held in the month of October, the President, the Executive Officers (except the Chairman and Deputy Chairman of the Council), the Hon. Librarian, Hon. Editor, Hon. Curator, twelve Members of Council and two Auditors for the ensuing year shall be elected (either Auditor having the power to audit the accounts in the unavoidable absence of the other). At this Meeting the Council's Report of the past year, together with those of the Chairmen of Sections, and the Hon. Treasurer's statement of accounts, duly signed by the Auditors, shall be submitted.

28.—Alteration in the Rules shall be sanctioned by a majority of not less than two-thirds of the Members present and voting at the Annual Meeting, or at a Special Meeting called for that purpose, and no alterations shall otherwise be made.

29.—Notice convening an Annual or Special Meeting, together with any proposed alterations in the Rules, shall be given to Members at least seven clear days before such Meeting be held. Notice of General Meetings, and Council Meetings (if possible) shall be given at least seven clear days beforehand.

30.—On a written requisition, signed by at least five Members of the Society, the Council shall call a Special Meeting to consider any question as to the affairs of the Society, such Meeting to be called within three weeks of the receipt of the requisition, and at least seven days' notice shall be given to the Members. At such Meeting no other business than that mentioned on the requisition, and on the notice convening such Meeting, shall be considered.

* * *

# Report of Summer Excursions, 1917.

**Blue Lake.** There were no General Excursions, but on Saturday, July 14th, a combined excursion of the Geological, Botanical, Entomological, and Photographical Sections, in which about 50 members took part, was made to the Blue Lake.

Assembling at Corfe, two parties were formed, one going direct to the Lake under the guidance of Mr. R. Y. Banks, the other walking along the Downs, a short description of the Geology of the landscape being given by Mr. W. Munn Rankin, of the Geographical features by Mr. Geo. Grace, and of the insect wealth of the district around Corfe due to the great variety of vegetation, by Dr. Penrose, Mr. C. B. Green pointing out plants of Botanical interest. Both parties met at the Blue Lake, which they were allowed to visit by the kindness of Mr. Arnold Pike, on whose property it is situated.

The greatest depth of the Lake is about 25 feet, where the colour is most intense, while in the shallowest places the colour almost disappears: the colour may be due to the light being reflected backwards and forwards among the minute particles of clay held in supension until the red rays are absorbed.

The particular clay for which the district is celebrated is the so-called blue clay, which is really white, but with a streak of blue in it, hence its name. This clay is incorporated in every kind of earthenware, its peculiar plastic nature rendering it necessary to the successful working of many other clays.

The remains of a Roman pottery at Norden makes it certain that the Romans worked the clay during their occupation of Britain, as also did the Phoenicians, who are believed to have commenced the workings at the same time as they discovered the tin deposits in Cornwall.

## Geographical Section.

**The Bourne Valley.** An excursion in the Upper Bourne Valley to Talbot was made by the Geographical Section on Saturday, August 18th, under the guidance of Mr. Claude Lyon and Mr. W. J. Woodhouse, the object being to see the sources of the little river which has given its name to the "Garden City" of Bournemouth.

The route taken was from Prince of Wales' Road, through the Upper Gardens. Halting on the way, Mr. Woodhouse gave an interesting account of the valley, the river's course, and the changes that time and the hand of man had effected. The party walked round the Coy Pond to see where the longest and most northerly of the four streams which form the Bourne flows in; it is called the Bourne Bottom Stream.

Ascending the steep hill beyond, from which an extensive view is obtained, and descending again to the valley, the Middle Bourne was crossed. Here are situated the clay pits belonging to the Pottery works; from thence a long straight road or track, called the Alders Road, said to have been used by smugglers, leads up to Talbot Village and Wallis Down. After the long walk, tea was welcomed by the party.

Appreciation of the excursion was much enhanced by copies of an excellent plan of the district made by Mr. Woodhouse and Mr. de Castro, which had been distributed among the members present, and also by the valuable information given by Mr. de Castro in a lucid account of the Valley.

# Notes on the Sections and their Work.

## Archæological and Historical Section.

CHAIRMAN: THE REV. H. SHAEN SOLLY, M.A.
SECRETARY: H. J. ELLIS.

Our first lecture for the Session was given by the Rev. F. A. Allen, M.A., who dealt with Modern Inventions—warlike, scientific, and miscellaneous—which had been anticipated in ancient times. In December a lecture was very kindly given us by Mr. Frank Stevens, Curator of the Salisbury Museum. It was entitled " Stonehenge of Yesterday and To-day," and was illustrated by many special lantern slides—altogether a very valuable contribution to our series, and much appreciated by a large audience. In January, Messrs. H. J. Ellis and Claude Lyon co-operated in giving a lecture on Egyptian antiquities, which was illustrated by slides prepared from objects in the British Museum.

For February I was unable to arrange a lecture, but in March I gave one on " Mediæval Italy "—covering a period of about 1000 years, usually regarded as a welter of confusion, but capable of being reduced to order by a study of existing monuments. Lantern slides to illustrate these were very kindly prepared by Mr. R. Y. Banks. We had one more indoor meeting in April, when Mr. Banks exhibited a large number of slides illustrating " Treasures of Northern Italy," showing work from the 13th to the 16th centuries in painting, sculpture, and architecture.

Two outdoor meetings were held. The first was in May at Wimborne, when Mr. S. C. Ryley co-operated with the Chairman in making local arrangements. The Rev. Canon Fletcher, M.A., vicar of the church, met us at the Minster, and after giving us a valuable address, took us round the building and pointed out features of special interest. Dr. le Fleming, custodian of the church muniments, showed us a number of ancient documents. A visit was then paid to the Grammar School, where the Rev. A. D. H. Allan kindly conducted us round. After lunch we walked to Lady Margaret's Lepers' Hospital, where Canon Fletcher gave a short history of this ancient foundation. We are greatly indebted to him for the fresh interest he imparted to our visit to this familiar town.

Our second outdoor excursion was to a still more familiar locality—Christchurch Priory. Here, also, much fresh interest was imparted in what was shown to the numerous members who gathered for the occasion, and who were reinforced by about eight members of the B.L.A.A., who accepted invitations to join us.

Our thanks were heartily accorded to the Vicar, the Rev. R. R. Needham, M.A., who gave us a kindly welcome and afforded us every facility; to Miss Tighe, who admitted us to the private grounds of the Priory; to Mr. H. J. Ellis, who made the local arrangements; and, most of all, to Mr. George Brownen, who took up the subject where it is generally left by the vergers, and made, out of his stores of erudition and original research, a very valuable contribution to our knowledge of this great treasure in our immediate neighbourhood.

H. SHAEN SOLLY.

## Botanical Section.

Chairman: Miss C. Agnes Rooper.
Secretary: G. C. Seeviour, A.C.P., F.R.H.S.

The work of the Botanical Section during the past year has been carried on with its usual energy. Two exhibitions of Wild Flowers were held in the Society's room, one in May and the other in July. The excursions undertaken were associated with other sections with the exception of one to Christchurch Meadows in May and one to Hinton Admiral in June. The Chairman, with the aid of Miss Jeffery and other ladies, arranged during the Summer Session a weekly Exhibition of wild flowers in the Municipal Library.

C. AGNES ROOPER.

### SPARTINA TOWNSENDI.

In several previous volumes the report of the Chairman of the Botanical Section has been followed by an account, by Mr. R. V. Sherring, F.L.S., of his observations on the growth of Spartina Grass in Poole Harbour. These observations have been continued by Mr. Sherring and the Hon. Editor has received from him (i) a general report; (ii) a schedule showing that, for the purpose of systematic Photographic Survey, the whole area to be surveyed has been divided into 15 sections; (iii) notes on each of 34 photographs belonging to certain of the sections just mentioned.

The schedule should be studied with the help of the sketch map facing page 42 of Volume V. of the Proceedings. The photographs cannot be reproduced here, but the notes, even by themselves, will be of use to those interested in the growth of the Spartina.

Mr. Sherring has also sent particulars of the discovery in Dorset, by members of the Society, of a plant new to Britain. His note on this subject follows those on Spartina.

# SPARTINA REPORT, 1917.

By R. Vowell Sherring, F.L.S.

The chief work this year has been confined to the headquarters of the grass and the Photographical Survey (by permit).

## Holes Bay.

Entering Poole by the S.D.R. the grass is first noted in Creekmore Lake. Here there has been a steady increase and, south of the Weymouth line, the matting together of the clumps forms a fine breakwater. Off Sterte a considerable increase in the size and connection of the clumps has taken place. On the west side of the Bay, from Hamworthy Bridge northward past Ham Wood, the thickening up has been considerable.

## Parkstone Bay.

Off Hospital Point there has been a great junction of the eyots into larger and thicker tracts; this is very apparent from the shore. Further south, at Whiteley Lake, this year at last shows a movement.

## South Haven to Brand's Bay.

Crossing the Haven and proceeding to Redhorn Quay we enter Brand's Bay. Steady progress up the creek continues. From Drove Island to Water Point is now a vast meadow, and thence to Goathorn Point the growth has been considerable. In the north, off Goathorn Point, the band of grass running E. and W. now forms a prominent object in the landscape, while eastward and south of the South Deep the band, curving away along the north of Brand's Bay, has a pretty effect. The increase is more than normal. Westward to Hill point, both on the shore and in the bands in the direction of Green Island, considerable headway has been made.

## Newton Bay.

The narrow opening of one thousand feet between Hill and Clavel Points gives the Bay a circular aspect, and the wooded shores outrival any in the Harbour. There is a considerable amount of grass, which is rapidly advancing and is killing out the *Scirpus maritimus*. Several days were spent here and the rich association of plants noted.

## Ower Section.

From Clavel Point to Ower Pier several days have been spent noting the vast meadows of grass sweeping away in every direction. Last year it has made one of the greatest advances in its history. Ower Lake, with a fine association of shore plants, occupied another day in examining the increase of the grass far up the creek.

## Fitzworth Point.

The most extensive view in the Harbour of the rolling meadows to N., E. and W. Two days were taken up in examining the rapid advance, which has changed the aspect of the grass from linear bands into vast sweeps of rapidly-forming meadows, while the Channel is rapidly closing and the thickening *Spartina*, right up to the shore of Round Island, now leaves little water-space. On all sides of the island and across the Wych Channel to the great Middlebere triangle is the largest acreage visible from one point in the Harbour. The increase in the Middlebere Lake is seen well from here.

### Wych Creek and Corfe River.

The vast sweep of advancing grass was shown to some members; on the E., to Nath Point and Round and Long Islands, to the W., to the triangle between the Wych and Middlebere Lakes.

### Wareham Channel.

No report for publication.

### Lytchett Bay.

There is a general thickening of the grass here.

## Remarks on Photographic Survey.

By R. Vowell Sherring, F.L.S.

Section I.—HOLES BAY, north of the Railway; south of the Railway..

Section II.—POOLE, to the Harbour Mouth.

Section III.—BROWNSEA ISLAND, north; south.

Section IV.—BRAMBLE BAY and JERRY'S POINT.

Section V.—BRANDS BAY.

Section VI.—GOATHORN.

Section VII.—GREEN and FURZEY ISLANDS.

Section VIII.—NEWTON BAY.

Section IX.—OWER BAY.

Section X.—FITZWORTH.

Section XI.—WYCH.

Section XII.—MIDDLEBERE, SHIPSTAL, and PATCHIN'S POINT.

Section XIII.—ROUND and LONG ISLANDS.

Section XIV.—WAREHAM to ROCKLEY RAILWAY BRIDGE.

Section XV.—LYTCHETT BAY.

## Remarks on the Sections.

Photograph
and
Date.

### SECTION I.—HOLES BAY.

No. 1, 1911.—Taken from (1) The Rectory Field, Hamworthy, looking to Ham Copse 40 points S.W. and to Lytchett Beacon.

No. 2, 1911.—Taken from (2) The Rectory Field, Hamworthy, looking across Holes Bay N.

No. 3, 1911.—Taken from (3) Rectory Field, Hamworthy, looking to Poole Church 70 points E.

No. 4, 1911.—Taken from (3) Rectory Field, Hamworthy, looking to Hamworthy Bridge, 60 points E.

## SECTION XI.—WYCH.

No. 5.—Taken from (5) Wytch Farm ploughed field, looking (W.) across the Corfe River to Middlebere Lake, Section 12.

No. 6.—Taken from (6) far up the Wych Creek, looking N., Aster Spartina Association.

No. 7.—Taken from (7) far up the Wych Creek, looking to Nath Point (N.) with plant association L.C. No. 824, 1644, 1743, 1746.

No. 8.—Taken from (8) Wych Creek, looking N.E. from the ploughed field with reed association, Wych Middlebere triangle of grass in the distance.

No. 9.—Taken from (8) Wych Creek, looking to Fitzworth, Round or Long Islands, reed association with Spartina.

All these taken before the war, the undated ones 1911 to 1913.

## SECTION VIII.—NEWTON BAY.

No. 10, 7/9/17.—Taken from (10) by the cottages at the south end of the bay, north over Green and Furzey Islands. Brownsea Island and Clavel Point on the left, Hill and Goathorn Points on the right, and archipelago of insular patches of *Spartina*.

No. 11, 7/9/17.—Taken from (11) ditto, ditto a few yards to the left showing more of Clavel Point on the left, the Channel (in centre), Hill and Goathorn Points on the right.

No. 12, 7/9/17.—Taken from (12) more to the left showing Game Copse in the distance and heavy grass accumulation.

No. 13, 21/9/17.—Taken from (13) Clavel Point. Shows west lobe of the bay looking about south-west.

No. 14, 21/9/17.—Taken from (14) Clavel Point, looking to Ower Farm and to left to field where No. 10 was taken from.

No. 15, 10/9/17.—Taken from (15) Clavel Point looking N.E., showing bands of grass at the mouth of the bay and off Hill and Goathorn Points.

## SECTION IX.—OWER BAY.

No. 16, 10/9/17.—Taken from (16) Ower Pier, Channel, Brownsea Island (pine trees), house-boat and end of Green Island on the right, and bands of grass east and west of Ower Channel.

No. 17, 10/9/17.—Taken from (17) Ower shore by pier with great sweep of meadowed grass to Clavel Point. Green Island to the left and Goathorn to the right.

No. 18, 21/9/17.—Taken from (18) the rising ground behind Ower Pier, showing Ower Channel, Round and Long Islands, Lytchett Beacon and the Fitzworth sweep of grass.

No. 19, 21/9/17.—Taken from (19) same as No. 18 but looking more to the right. Companion and joining on to No. 18, still showing the vast sweep of grass.

No. 20, 7/9/17.—Taken from (20), from field east of Ower Pier, showing the big sweep of grass.

No. 21, 7/9/17.—Taken from (21). Companion picture to No. 20, lookng more to the east.

No. 22, 7/9/17.—Taken from (22). Companion to Nos. 20 and 21, Brownsea and Green Islands in the distance.

## SECTION X.—FITZWORTH.

No. 23, 24/9/17.—Taken from (23). A little path goes from the cottages up through the heath to the end of the rising ground. The two first, Nos. 23 and 24, were taken to the left of the path a few yards up, Nos. 25, 26 and 27 from the highest ground on the point, and the last, No. 28, from two or three yards back from the point and east of path. Looking across Wych Channel up Middlebere Lake, showing the *Spartina* at the entrance of the Round Island and Fitzworth Channel also showing the great Middlebere Wych angle of meadowed grass.

No. 24, 24/9/17.—Taken from (24) across Wych Channel to Gripp Heath; Arne shore, Shipstal and Patchin's Point in the distance. This view embraces the entrance from Wych Channel between Fitzworth Point and Round Island, which is rapidly closing, like the Round Island and Long Island passage. On the left will be seen the now narrow entrance and all that remains of the Round Island—Fitzworth Channel. See Nos. 25 and 26.

No. 25, 24/9/17.—Taken from (25) at the point. Round Island Channel and Shipstal Point in distance. Grass starting to meadow east of the island.

No. 26, 24/9/17.—Taken from (26), same as No. 25 but Round Island in centre.

No. 27, 24/9/17.—Taken from (27) same place as Nos. 25 and 26, showing the rapid approach to meadowing of the Fitzworth bands and the closing of the Channel. Two years ago I was demonstrating to members of the Bournemouth Natural Science Society here on the line-like aspect of the bands of grass, which is now hardly apparent, only a trace in the photograph. Brownsea, Furzey and Green Islands and Goathorn Point in the distance.

No. 28, 24/9/17.—Taken from (28) a few yards east of the Point, showing the remains of the line-like bands better than No. 27; Poole shore on the left and centre, Brownsea Island on the right and in the distance.

## SECTION VI.—GOATHORN.

No. 29, 29/9/17.—Taken from (29) the end of the pier; Goathorn Point and Green Island with bands of grass off both places.

No. 30, 29/9/17.—Taken from (29) same as No. 29; Green and Furzey Islands with grass bands also off Goathorn Point.

No. 31, 29/9/17.—Taken from (29) sams as No. 30, and is a continuation of the same view.

No. 32, 29/9/17.—Taken from (29) as others from Goathorn Pier, showing the rapidly-forming bands of grass. On the left is Brownsea Island, with Sandbanks in the distance.

## SECTION V.—BRANDS BAY.

No. 33, 29/9/17.—Taken from (33) the shore end of Goathorn Pier looking to Water Point.

No. 34, 29/9/17.—Taken from (34) at Water Point, showing vast meadows of grass surrounding Drove Island.

R.V.S., December, 1917.

## POTAMOGETON UPSALIENSIS.

First found by Miss Ida M. Roper, F.L.S., and R. Vowell Sherring, F.L.S., at Bindon Mill Pond, June 28th, 1916, and in the River Frome, near Wareham, by R. V. Sherring on September 14th, 1916. The first locality was confirmed, by request, on August 9th, 1917, by Miss Ida M. Roper, F.L.S., R. V. Sherring, F.L.S., and Mrs. E. Rothwell, members of the Bournemouth Natural Science Society.

A series of fresh specimens was sent by Miss Ida M. Roper to Mr. A. Bennett, and an interesting and important note by that authority is given in the Journal of Botany, Vol. 55, Dec., 1917.

R.V.S.

# Entomological Section.

Chairman: F. G. Penrose, M.D., F.R.C.P., F.Z.S.
Secretary: W. G. Wallace.

During the session there were seven meetings and three excursions. At the opening meeting on December 7th Mr. W. Parkinson Curtis, assisted by his brother, Mr. E. Harker Curtis, gave a demonstration of their method of setting butterflies and moths.

On January 11th, Mr. George Grace, B.Sc., gave a very interesting lecture on Colour Protection amongst insects, illustrated by a most beautiful series of hand coloured slides painted by Mrs. Grace. Followed by a general discussion.

On February 8th several members exhibited their series of Clouded Yellow Butterflies (*Colias edusa* and *hyale*).

On April 26th an exhibition of the Blue Forms of Females of the British Blue Butterflies, Lycænidae.

There were a very considerable number of varieties shown.

On May 17th an exhibition of living larvae, etc.

On June 14th an exhibition of Clear Wing Moths. Mr. Parkinson Curtis and his brother showed a very complete collection containing a nearly complete series of the British species.

On July 19th an exhibition of various specimens.

At all the meetings members brought various interesting exhibits.

**Excursions.**

On May 26th and June 2nd there were excursions to the hills at Corfe. The first was very informal owing to the weather being doubtful, but that on June 2nd was well attended and very successful. The excursion to the Blue Pool on July 14th was in conjunction with several other sections; a report appears elsewhere in this volume.

### Individual Work by Members.

Mr. Grace suggested to me that very valuable results might in time accrue if members would give a statement at the end of each season of their observations, captures, etc., during the season and a general record printed each year in the Annual Proceedings. In accordance with this suggestion, several members have furnished reports, the substance of which is given in the digest prepared by Mr. Wallace and printed below.

F.G.P.

## Entomological Report, 1917.

Reports on entomological observations have been received from Messrs. W. P. Curtis, F.E.S., E. H. Curtis, and Geo. Grace, B.Sc., from which the following notes have been prepared:—

The outstanding feature of the 1917 season was the unusual abundance of insect life throughout the year. This was especially marked in the case of *Pieris brassicæ* (the Large Garden White) and *P. rapæ* (the Small Garden White). In the opinion of Mr. W. P. Curtis there was a migration of these insects about the third week in April, 1917, following on a S.E. wind. They were probably accompanied by *Colias edusa* (the Clouded Yellow), *Pyrameis atalanta* (the Red Admiral), *P. cardui* (the Painted Lady), *Vanessa urticæ* (the Small Tortoiseshell), *Vanessa Io* (the Peacock butterfly), and *Phesia gamma* (the Silver Y moth). Mr. W. P. Curtis further states that the second brood of larvae of the two Pierids (Garden Whites) was disastrously voracious, but the parasitic Microgaster had by the third brood increased to such an extent that the normal spring brood of 1918 will probably not be very abundant.

The Vanessidae were all extremely numerous in the Autumn.

The exceptional abundance of insects is attributed by Mr. E. H. Curtis to the remarkable scarcity of birds, most particularly of residents, resultant upon the toll of the severe winter of 1916-1917, which afforded little respite to bird life and, in his opinion, the effect of this may be still more apparent in 1918, particularly with spring feeding insects, though the wet August and September may have modified this result by reason of the myriads of larvae destroyed by excessive rain and moisture.

In this connection Mr. W. P. Curtis attributes the fact that the large Fritillaries reappeared in the Poole district with some degree of abundance after a very long absence, partly to the great reduction of pheasants, which destroy low feeding larvae like those of Argynnis.

In addition to the insects already named, Mr. Grace notes that *Satyrus semele* (the Grayling) has been exceedingly prominent, especially on the heath to the west of Talbot Woods, where the paths, etc., afford excellent opportunities for the display of the striking similarity between the patterns of their wings and the black and white patches of the gravelly soil. He also records the frequency of *Cetonia aurata* (the Rose Chafer) and the discovery of a vigorous colony of *Criocephalus ferus* near Coy Pond. This is the first time this beetle has been recorded as breeding in the district. During this summer practically every fir stump in an area almost half a mile long, running westwards from Talbot Woods, was burrowed by the larvae, but hardly any traces of it were found outside this area.

Mr. Grace also observed the unusual prevalence of *Chrysops quadratus*, a blood-sucking fly, on Furzebrook Heath.

The larvæ of *Acherontia Atropos* (the Death's Head Hawk-Moth) were found much more frequently than usual in 1917.

The following rare or unusual insects were observed:—

March 4.—*Asphalia flavicornis*, from Canford larvae. An insect not previously met with in the locality. (W.P.C.)

May 9.—*Selenia tetralunaria*, from Canford larvae. Not previously found in this locality by Messrs. Curtis. (W.P.C.)

May 11.—*Plusia moneta* larvae at Stanley Green. A new locality for this insect. (W.P.C.)

June 1-14.—*Bupalus piniaria*, forma typica (bred). An unusual occurrence, as the southern form is *var. flavescens.* (W.P.C.)

June 14.—*Atolmis rubricollis* (bred). Common round Poole 25 years ago, but not previously found by W.P.C.

June 17.—*Stauropus fagi*, bred from Canford Bottom larvae, thus confirming a century old record which had not since been verified. (W.P.C.)

June 22.—*Palimpsestis duplaris*, northern form, bred from Canford Bottom larvae. A very uncommon insect at Poole. (W.P.C.)

July 14.—*Hyloicus pinastri* was taken at Bridport by Mr. W. W. Male. (W.P.C.)

July 15.—*Ennomos erosaria*, bred from Canford larvae, a further accession to the local list. (W.P.C.)

July 22.—*Callimorphia dominula*, found at Canford. (E.H.C.)

July 22.—*Zephyrus quercus*, *Argynnis adippe*, *A. aglaia*, and *A. paphia*, were all fairly abundant, though they had not been at all common in this district since 1895. (W.P.C.)

August 31 and October 8.—*Catocala nupta*, two specimens were captured at Poole, the first of the species from the locality seen by W.P.C.

W.G.W.

## Geographical Section.

CHAIRMAN: CLAUDE LYON.
SECRETARY: W. J. WOODHOUSE, A.C.P.

The Geographical Section carried on its work with success during last season. The lectures were, the Chairman ventures to think, well up to the average in number and interest; the large audiences by which they were attended were, indeed, a proof of their popularity.

Owing to the War the excursions were fewer than usual: two took place in conjunction with the Physical Section. Both these, thanks to the excellent arrangements which had been made by the management and staff at the works visited, were most successful.

Mr. Lyon was again most efficiently assisted by Mr. Woodhouse, his energetic Secretary, to whom he would again tender his heartiest thanks.

Through the Chairman of this Section, Mrs. Philpott very generously presented to the Society the valuable collection of Egyptian Antiquities which she and her late husband had gradually accumulated during their many visits to Egypt. These Egyptian objects are among the most interesting and valuable of the various collections now in the possession of the Society.

C.L.

## Geological Section.

CHAIRMAN: W. MUNN RANKIN, M.SC., B.SC.
SECRETARY: GEORGE GRACE, B.SC., A.R.C.S.

During the winter session a large number of lectures were given, as a rule two a month. The chief feature was a course of lectures on the Kimmeridge Oil Shales; by the Chairman, on the geology, Mr. A. Swinney on the mining, and Mr. A. Teichfield on the chemistry. The series was closed by a symposium in which the various points of the subject were summarised and other members of the Society took part.

W.M.R.

## Photographical Section.

CHAIRMAN: R. Y. BANKS.
SECRETARY: EDWIN DODSHON, LL.D.

This Section has maintained its activities throughout the year though in a somewhat restricted form. Much work has been done by several members in preparing slides for the various lectures, and these, with many of a record nature, have brought the number up to over 1,200.

The two exhibitions of Prize Slides from the "Amateur Photographer" and "Photography and Focus" were very much appreciated by the members, and the lecture by Mr. Chas. Riddle on "Bournemouth, Past and Present" gave a healthy impetus to the Society's endeavour to get records of all that is interesting in the district covered by the Society's map. Mr. Dodshon's lecture on "The Photography of Trees" was useful and instructive. The Chairman's contribution, in conjunction with the Archæological Section, was a lecture on the "Art Treasures of Italy." The excursion to the Blue Lakes, at which Mr. Brumell secured a picture which was successful in gaining a prize in the competition held in November, 1917, is referred to on another page.

R.Y.B.

## Physical Section.

CHAIRMAN: HUBERT PAINTER, B.SC., F.C.S.
SECRETARY: [HENRY LE JEUNE.]

Of the six lectures given during the Session, four dealt with some important article of human consumption such as Bread, Salt or Sugar. Salt was suggested to the Chairman as a promising lecture subject by Mr. Le Jeune, whose death is a truly heavy loss to the Section and the whole Society. Mr. Le Jeune made stands for the Velocity of Sound apparatus shown at the last lecture of the Session and acted as Conductor of the Excursion of August 15th; the arrangements for which had been largely made by him. Elsewhere in this volume is a fuller tribute to his memory.

H.P.

## Zoological and Microscopical Section.

CHAIRMAN: F. G. PENROSE, M.D., F.R.C.P., F.Z.S.
SECRETARY: H. B WELLS, F.R.M.S.

On December 7th, 1916, a Lantern Demonstration was given by the Chairman of the Section on a selection from the Bird slides in the Batley Collection belonging to the Society, in which an endeavour was made to bring before the members some idea of the value and beauty of their property.

On February 15th a very successful microscopical meeting was carried through by Mr. Wells, the Secretary of the Section, and Mr. Taylor, several slides being shown and explained.

F.G.P.

# A Selection from the Lectures and Papers given before the Society.

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Report on a Special Course of Five Lectures on

## "The Resources of the Empire and the Splendid Services Rendered by Our Overseas Possessions in connection with the War."

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### I. The Resources of our Oldest and Nearest Colony—Newfoundland—and what it has done and is doing for the War.

(Delivered at Trinity Hall, December 16th, 1916.)

By Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.

Chairman: Sir Ralph Champneys Williams, K.C.M.G.,
late Governor of Newfoundland.

Sir Daniel Morris gave a sketch of the history of Newfoundland from the time of its discovery by Cabot in 1497. He spoke of the first permanent settlement in 1610 and drew attention to the special connection with Newfoundland of our own West country. Not only did many of the earlier settlers come from Dorset, but a regular intercourse with the Colony was maintained, down to a period within living memory, by fleets of fishing vessels sailing from Christchurch and Poole.

The lecturer also spoke of the natural features of the country; its area, population, and government, and of its immense forest resources, now being utilised for the manufacture of wood-pulp for paper-making. Special reference was made to the cod fisheries, the largest and most valuable in the world. Then followed an account of the many services which the Newfoundlanders have rendered in connection with the war, a tribute being paid to the gallant fighting of the Newfoundland contingent both at Gallipoli and in Flanders. During its several centuries of eventful history the Colony had never enlisted a force for foreign service, but, in the present crisis, the call of Empire was loud and clear and Newfoundland responded loyally. This response has earned for our oldest Colony a place of distinction in whatever scheme for closer Imperial Federation may be developed after the war.

## II. New Zealand and the War.

(Delivered at Trinity Hall, January 13th, 1917.)

By the Right Hon. Sir Joseph George Ward, Bart., P.C., K.C.M.G.,

Minister of Finance, late Prime Minister of New Zealand.

Chairman: Sir Daniel Morris, K.C.M.G., D.Sc., D.C.L.

Sir Joseph Ward began with an emphatic assertion of the essential unity of the Motherland and the Dominions. He and his hearers alike were citizens of the one British Empire. New Zealand, he continued, is one of the most beautiful of countries. Its area is nearly equal to that of the United Kingdom and its fertility is unmatched. The population, at present 1,156,000, will greatly increase, and the time has already come when New Zealand and the other Dominions should have a voice in matters concerning the Empire as a whole. When the war broke out New Zealand offered her help without waiting to be asked. Samoa was taken, 61,000 men sent to the war and others were in training, so that from her small population a contingent of 80,000 would be provided. Many had already been killed or wounded, but fresh men were sent to take their places. The people had contributed £2,000,000 for comforts for their own troops and £762,000 to help the Belgians and Serbians. They were financing themselves without assistance from the mother-country and had raised £11,000,000 for local purposes and war requirements. There was no murmuring at the taxation necessary, for the people were resolved that the war should be won. The soldiers, their wives and dependants and the widows and children of the fallen were looked after with a liberality of which the speaker was proud. The pension for widows, for example, had been fixed at £3 per week, but was afterwards increased to £4 or £5. To the Imperial Navy, New Zealand had contributed a Dreadnought costing £2,000,000, and this ship had already played an honourable part in the naval battles of the war. Political strife had ceased in New Zealand. The present Prime Minister and the speaker had been leaders of two opposing parties, but now they were colleagues in the same Ministry. Sir Joseph, in conclusion, said that the people of New Zealand, like those of England, were determined never to yield to foes who have committed cold-blooded murders on land and sea and violated every established usage of civilised warfare. There must be no premature peace. The British Empire represents freedom and justice and it is for freedom and justice that we and our Allies are fighting and will continue to fight until victory has been won.

## III. Australia and the War.

(Delivered at Trinity Hall, February 17th, 1917.)

By the Hon. John Greely Jenkins,
late Prime Minister of South Australia.

Chairman: Sir George Ruthven Le Hunte, G.C.M.G.
late Governor of South Australia.

The island continent of Australia, said Mr. Jenkins, is more than twenty-five times as large as the United Kingdom. Parts of it have only a small rainfall, but other portions have an abundant supply of rain, and the Murray is one of the largest rivers of the world. As a whole the climate is decidedly healthy and well suited to the British race. Its population is small in comparison with its area, but it is interesting to note that no less than 95 per cent. of the inhabitants are of British origin, so that it is the most thoroughly British of all the great Dominions. Before the war the men exceeded the women by 200,000; it is hoped that this inequality will be rectified by female immigration from Great Britain. The Government is very democratic and is of a dual character, that of the separate States, New South Wales, Victoria, Queensland, South and West Australia, Tasmania, on the one hand, and the Commonwealth on the other. The relations between the States and the Commonwealth differ considerably from those between the States and the Dominion in the case of Canada.

In Australia all matters appertain to the State Governments except those which, by the constitution, are especially reserved for the Commonwealth. The industries are numerous and important. Immense numbers of sheep are raised and the production of wheat, butter, wine and fruit is on a very large scale. The mineral wealth of the country is enormous and varied. Even before the outbreak of the war the Australian people foresaw that sooner or later there would be a call to the defence of their own country and of the Empire of which they are glad to form a part. A system of national training was inaugurated. This consisted of a preliminary training of junior cadets of from 12 to 14 years of age, leading to a fuller drilling of senior cadets of from 14 to 18, and culminating in the training of the citizens' force of men from 18 to 26. As a result of these measures there are over 700,000 men between 18 and 35 mostly fit for service, the majority of whom are having, or have had, at least some training in drilling, marching and shooting; also, in many cases, in riding. When war was declared Australia took immediate action. Volunteers poured in from every part, and the promptest preparations were made for transport. The Australian Navy has to be credited with the running down of the notorious raider, the Emden, and with the seizure of German stations and territory in the Pacific. Australian soldiers in Gallipoli, in France, and in other theatres of the great conflict, have behaved with extraordinary valour, and very many have gladly given their lives for their country, for liberty, and for the Empire to which they are proud to belong. The late Earl Kitchener in February, 1916, paid a splendid tribute to the great effort that Australia had even then made, and spoke in the warmest terms of the Anzacs and the spirit they displayed. The Governments of the Commonwealth and of the States have already begun to consider post-war problems. They have agreed upon schemes of settlement in Australian lands, not only for Australian soldiers and sailors but for such British soldiers and sailors as may desire to share in the free and spacious life which Australia can offer them. These schemes differ in details for the different States but agree in including free, or nearly free, grants of land, together with financial assistance and expert advice in its development. The Dominions fully recognise the advantage of being parts of the great British Empire. Free in their domestic politics they prize their connection with the great centre of the Empire, and are proud to be called children of the Mother Country. But they have now arrived at such an age and such a state of prosperity and importance that they desire to be treated as grown-up members of the family and to be called to the Home Councils, as we are pleased to see they are now being called, for consultation and advice. In all the Dominions beyond the seas there exists the strongest feeling of loyalty and patriotism. That feeling has been emphasized by the blood of their stalwart sons in Gallipoli and France. They are fighting side by side with the brave soldiers of these Islands, animated with the one desire to protect this great Empire from the brutality of Prussianism and to advance the cause of liberty and humanity.

## IV. Canada and the War.

(Delivered at the Winter Gardens, March 16th, 1917.)

By Lieut.-Colonel Richard Reid,
Agent-General for Ontario.

Chairman: Sir Daniel Morris, K.C.M.G., D.Sc., J.P.

Lieut.-Colonel Reid began by giving an account of the area, physical features, and natural resources of Canada. He then spoke of its population and system of government, and described the great contribution the Dominion has made towards the prosecution of the great war. He recounted some few of the many gallant deeds performed by the Canadian Contingent. The audience was greatly surprised and pleased to hear that no fewer than 1,500 of the Indian population are fighting side by side with Canadian soldiers of British and French descent. The lecture was followed by cinema pictures illustrating Canadian life.

## V. The Crown Colonies and the War.

(Delivered at Trinity Hall, April 21st, 1917.)

By Sir Everard im Thurn, K.C.M.G., C.B.
late Governor of Fiji and High Commissioner of the Western Pacific, formerly Lieut.-Governor of Ceylon.

Chairman: The Mayor of Bournemouth (Alderman H. Robson).

Sir Everard im Thurn described the contributions in men, money and materials made by the Crown Colonies from the outbreak of the war down to the time at which he was speaking. He dealt, as might have been expected, most fully with those Colonies in which he had himself been His Majesty's representative. British Crown Colonies are to be found alike in the Eastern and Western hemispheres, north of the equator and south of it. They differ in area, in population, and in the proportion of colonists to native inhabitants. The systems of government are also very various but, in this great time of testing, the devotion of the inhabitants of British birth or descent and the loyalty of the native races, have everywhere been conspicuous.

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# THE PROBLEM OF KIMMERIDGE SHALE OIL.

*A Series of Papers read before the Geological Section*

BY

W. Munn Rankin, M.Sc., B.Sc.
January 17th.

A. Teichfeld.
January 31st.

A. J. G. Swinney, M.E., M. Inst. M. & M.
February 21st.

## The Geology of Kimmeridge Oil Shale.

By W. Munn Rankin.

The small village of Kimmeridge lies secluded from the world across Poole Harbour and the Frome, the great heathlands and the two ridges of Purbeck. It has, however, been long famous in Geology, having given the scientific name not only to the thick clays that lie immediately round about it and end in high sombre cliffs between St. Alban's Head and Gad's Cliff, but also to the great stretch of similar clays that range across England from Dorset to Cambridge and continue through Lincolnshire into Yorkshire. Kimmeridgian limestones, sandstones, and clays also form extensive outcrops in Eastern France.

Kimmeridge Clay is interesting geologically for its varied assemblage of animal remains that cover a wide range of types. and economically from the occurrence of extensive seams of bituminous oil-shales found interbedded within it. The growing importance of mineral oils in modern life and industry has drawn attention to the occurrence of oil-bearing deposits in Britain. The extensive use of oil by the Imperial Navy makes it essential that sooner or later our country should provide from its own mines a fully adequate supply of that material. Mr. Winston Churchill, when First Lord of the Admiralty, referred to the considerable potential supplies of the Kimmeridge oil-shales. More recently active investigations have been in progress on the Kimmeridge Clay in Norfolk, where very rich seams have been proved. But at present no oil is won on a commercial scale from any Kimmeridgian deposits, though it is not too much to say that if they had occurred in any other country than Britain, both capital and industry would long ago have been adequately applied to them.

In its development in the type locality, Kimmeridge Clay forms the undercliff of St. Alban's Head on the east, and of Gad's Cliff on the west. In both places the upper heights of the great sea cliffs consist of Portlandian Sand and Limestone. The clay forms also the basis of the Vale of Kimmeridge, which lies at the foot of the scarp of the ridge of Portlandian rock and ends on the coast as a fine section of high sombre cliffs, continuous for five miles between Chapman's Pool and Brandy Bay.

Kimmeridge Clay forms, with the Portland Sand and Limestone, and the Purbeck beds of Marls and Limestones, the upper division of the Jurassic Series. It rests upon the Corallian Limestone with Oxford Clay, which, according to some classifications, are also included in the upper Jurassic Series but more generally in the middle.

The extensive development of Kimmeridge Clay in the neighbourhood of Kimmeridge is due to the operation of the upthrust of the main Purbeck Anticline, which here attains its maximum; the axis running more or less west and east inland from the cliff at Hobarrow Bay, where the lowest beds are elevated. The beds dip sharply on the west under Gad's Cliff and at a moderate angle towards the south-east beneath St. Alban's Head. It consists of rather gloomy-hued shales with many partings of harder rock of clayey limestones, which, when weathered out by sea action, form a series of ledges running for some considerable distances across the foreshore. The many faults are emphasised by the distinct partings of these hard belts. The bituminous shales occur in the upper division of the clay as a few seams of "coal."

The next exposure of Kimmeridge Clay along the Dorset coast is at Ringstead, just past the high cliff at White Nothe. In part it forms the basis of the cliff below Holworth House, where, together with Portlandian and Purbeckian beds, it is diagramatically overlapped by the Gault and shows that it had been subject both to tectonic folding and denudation in pre-Cretaceous times.

About Portesham, Kimmeridge Clay appears as fairly extensive but strictly local exposure. It also forms the basis of the Isle of Portland as an overgrown and obscured undercliff on the north of the Isle.

Kimmeridge Clay runs more or less continuously from Dorset inland across England to the Wash as a member of the Jurassic belt, forming much of the floor of the clay vale lying between the chalk escarpment and the oolitic and liassic escarpments further north. In North Dorset it thus forms much of the soil of the Vale of Blackmoor, which in old times was heavily wooded with oaks, but has now long been the pasturage of great herds of cattle, and so well named by Thomas Hardy as the "Vale of Little Dairies." In Wiltshire it is well developed as one of the series of Jurassic rocks, for which this country is famous, and comprises much of the Vale of Wardour and most of the Vale of the White Horse, and is here also famed widely for its dairy-lands and locally for the bricks and tiles made from its material. In Berkshire, as in Oxfordshire, it is maintained, though of little thickness. It is almost entirely missing in Bedfordshire, though it reappears just across the Cambridge border in strong development. It forms the floor of much of the Fen district, and the mass of the several "isles" which were practically the only dry land in times past and on which most of the towns and villages stand. The Clay of Norfolk has recently come into more prominent notice, from the successful search for oil shales. In a lenticular depression, with its centre near the village of Wormegay, bituminous shales are interbedded with ordinary shales, and from these oil has been obtained. Here the series appears to have suffered a fair amount of denudation immediately after consolidation, for the Portlandian and Purbeckian rocks are both missing. Kimmeridge Clay forms the floor of the Vale of Pickering between the North York Moors and the Wolds, but its only decent exposure is on the coast in Speeton Bay. The ancient Kimmeridgian sea extended far northwards to the uttermost parts of Scotland, for the formation is represented in Cromarty and Sutherland by a thick and variable series of estuarine sandstones in the lower part, and marine grits, shales and limestones above. Near the Ord of Caithness it consists of rough blocks of derived rock mixed with the fossilised timbers of trees that had been washed down into the sea from the Scottish Highlands of the period.

In addition to these evident exposures of Kimmeridge shales are several concealed basins where they have been proved to occur in considerable development. These are the concealed basins of the Weald of Sussex, of Kent, and of Saffron Walden.

The likelihood of the occurrence of Kimmeridge Clay in Sussex was very early recognised from the outcrop of Purbeckian rocks near Battle. The famous sub-Wealden boring made in 1872 in this outcrop in search for the paleozoic rocks proved the clayey oolites to attain considerable thickness, some 1,000 feet of Kimmeridge Clay being followed by an almost equal thickness of Oxford Clay, in which the boring was finally abandoned. The later borings for coal in the Kent area have added to our knowledge of the extent and thickness of the concealed Kimmeridge Clay. At Penshurst it is over 600 feet thick. Nearer Dover the thickness rapidly diminishes, in some places being altogether missing, as if the pre-cretaceous denudation had been there very active. It is interesting that what appears to be the greatest thickness of Kimmeridge Clay should be within a short distance of the shore of the Kimmeridgian sea. Evidently, the sinking of this sea floor was much more rapid and continuous there than further out to sea. Another striking feature is that it is practically coincident in extent with the region of the greatest upheaval which, in Miocene times, developed the Wealden anticline

The Essex-Kent basin probably covers the greater part of the counties of Kent, Essex and Cambridge, and is divided geographically by the Thames estuary into two areas.

Jurassic rocks generally are well developed in France, forming at the surface a rough figure 8, the northern circle practically enclosing the Paris Basin and the southern ringing the paleozoic and igneous rocks of the Central Plateau. Kimmeridgian rocks contribute much to the topographical features of the eastern borders of the Paris Basin against the Ardennes and the Lorraine plateau. The harder beds form the western heights of the Meuse near Verdun. Kimmeridgian rocks also form a most interesting part of the extension of the English Weald into the the district immediately round Boulogne, there forming a grand arc of cliffs enclosing the area a few miles outside the town. Here the formation consists of sandy shales, clays and limestones, and is covered by Portlandian rocks. A similar facies of the formation is developed near the Meuse.

Leaving the question of the geographical distribution of the Kimmeridge Clay we now come to consider its stratigraphy. The thickness of the clay varies considerably from district to district in its range across England. It is thickest in the South Coast exposures and borings, but, like the other stages of the Upper Jurassics, it becomes notably thinner in the Midlands, again increasing in Yorkshire. This variation in thickness is in all probability due to the irregularity of the rate of deposition of the constituent material upon the floor of the Kimmeridgian sea. This irregularity in turn may be connected with either a change in the rate of subsidence of the floor from district to district, or a local variation in the supply of silt carried down from the bordering lands by rivers according to the shifting of their estuaries. The prevailing sombre colour of the deposits is sometimes ascribed to rocks, exposed and wasted in Kimmeridgian times, being in all probability coal measures and the slates of the still older Silurian and Ordovician rocks of the Wales of that time, and of the paleozoic platform still existing beneath London, and of the other ancient rocks of Belgium and France.

The great thickness—some 1,000 feet—in Dorset and Sussex shows the subsidence to have been greatest there. Another considerable subsidence in the North of England and Scotland was filled in steadily by the fine silt and coarser waste of the then existing Pennines and Highlands. The subsidence of the Midland range of this clay was apparently hindered by the concealed ridge of ancient resistant rock still forming the lower floor of the district and exposed to a slight extent in Charnwood Forest.

After deposition the Kimmeridge Clay was raised, and either inshore deposits, such as the Portland Sands and Limestones, were laid upon it or it suffered marine or aerial denudation. In Dorset the series is complete, though even at Ringstead the almost level Gault rests upon the highly-tilted Purbeck and Portland strata. The axis of the dominant post-Jurassic anticlinal movement was thus some distance from Dorset, and appears to have been near Sandy, where all the Upper and part of the Mid-Jurassic beds are missing.

The zonation of the Kimmeridge Clay presents several difficulties, and is still not definitely settled. According to Professor Blake the Dorset Kimmeridge beds fall into two divisions:—

**The Upper Kimmeridgian,** 650 feet thick, composed of paper shales, bituminous shales, with cement stones and clays. This division is not remarkably rich in fossil remains. It is near Chapman's Pool and Brandy Bay.

**The Lower Kimmeridgian,** 183 feet thick, with a rich assemblage of fossils. The beds are best developed in Hobarrow Bay, where the lowest strata, but not the actual base, are seen in Broad Bench. This division is remarkable at Kimmeridge for the number of clayey limestones, which maintain their individuality for considerable stretches of cliff sections and form the striking roughly parallel ledges across the shore.

The actual plane of separation between the Upper and Lower divisions is not determinable. The passage of the Upper Kimmeridgian into the overlying Portland Sands is even more uncertain, so that the line of separation mapped by geologists is a matter for debate.

The French Kimmeridgian is divided into several zones, according to the occurrence of certain distinctive fossils, viz.: 4 Bononian, 3 Virgulian, 2 Pterocerian, and 1 Sequanian. The Bononian, in the type district of the Boulonnais, though sometimes referred to the Lower Portlandian, is really a sandy and conglomeratic facies of the lower part of the Upper Kimmeridgian, being the littoral deposits against the slopes of the Ardennes, which were laid down contemporaneously with the clay and cement stones in the deeper and quieter waters over Dorset, further west. Nothing strictly corresponds, either lithologically or paleontologically, in North-east France with the Upper Kimmeridgian of Dorset.

The Virgulian of the French geologists, according to Huddleston, corresponds with the upper beds of the Lower Kimmeridge Clay of Dorset, wherein *Exogyra virgula*, the type fossil, first appears, as the beds are considered from above downwards. The Dorset Virgulian beds are developed in Kimmeridge Bay between Hen Cliff and Brandy Bay, where the uplift effecting the Purbeck Anticline has its axis cut by the coastline.

The bituminous shales are found in the Upper Kimmeridgian of Dorset and at similar horizons throughout the belt across the Midlands, but outside Purbeck nothing much has been done at any time in the way of mining. The Kimmeridge Shales concealed beneath the Weald are almost certainly rich in bituminous seams. The natural gas of Heathfield demonstrates the presence of gas, there stored in the Hastings Sands and most probably derived by natural distillation from the Kimmeridge Clay below. This supply was at one time used to illuminate the railway station, and it was even proposed to light Eastbourne from it. Oil oozes out in small quantities from the Kimmeridge shale dug from the Norfolk seams. With these exceptions the bituminous shale yields gas or oil distillates only on heating, the bituminous substance, whatever it is, being held in some sort of combination or intimate mixture with the inorganic matrix of the shale.

While reserving the fuller discussion of the origin of petroleums in general for a later part of the present series of papers, it appears safe to affirm that the original substance of the Kimmeridge Oil was fully organic; whether purely animal in character or purely vegetable or a mixture of the two is not certain. There are no indications whatsoever of volcanic action that might have spread mud charged with hydrocarbons on the floor of the sea, as is suggested by one school, or of any serious tectonic movements during Kimmeridgian times, either in Dorset or elsewhere in Britain or the Continent, which might have caused dykes to have opened out, along which bituminous substance poured from below. The faults shown in the sea-cliff sections are all post-Kimmeridgian; some possibly pre-Cretaceous and others of early or mid-Tertiary times.

It is maintained by some that certain bituminous shales, akin to Kimmeridge shales, are genetically related to the coal measures that occur in the same deposits at identical or different horizons. Both shale and gas coal have been worked for oil in various places in the English and other coalfields. Kimmeridge Clay is one of the many formations which comprise the Jurassic System, in which, in certain deposits of a littoral facies, as in East Yorkshire and North Scotland, considerable quantities of coal derived from a rich land vegetation are enclosed. Kimmeridge Clay itself in Dorset and the Midlands generally is, however, a typical deposit of a fairly deep and extensive sea, and does not contain any recognisable plant remains. These were doubtless carried down into the sea, but were either completely rotted or were accumulated under favourable conditions near shores at some distance from Dorset. It is, however, conceivable that vast accumulations of the decaying waste of extensive mats of seaweed floating at the surface, like the Sargasso weed of the present day, may have gradually settled down on the floor of the sea and there, mixed with the fine inorganic silt, have undergone some slight further decay before being finally locked up and consolidated as bituminous shale.

Another possible source of the bitumen has been suggested in the coal measures, which were possibly extensively exposed to denudation over Britain and to the south-east over Belgium and France, in the land surface of the Kimmeridgian period. Just as the dark and sombre clays, shales and slates of the carboniferous and earlier systems may have contributed largely to the accumulation of the clays which form by far the greater mass of the Kimmeridge formation in England, the seams of coal may have provided, after ultimate disintegration, the carbonaceous material out of which the bituminous oil-shales were accumulated. No recognisable fragments of ordinary Coal-Measure coal have, however, been yet recognised in the oil-shale, which is indeed usually leather brown and not grey or black.

Though the Kimmeridge sea was shallow and contained no great volume of water and became heavily charged with mud from its land borders, it was yet fairly extensive, both in width and length. It is, of course, possible that within the depths of such an extensive sea, not only the varied vegetable waste, but also the coal fragments carried down by the rivers into the sea were reduced by maceration and partial decay to a richly organic mud, and that this was slowly deposited at certain stages in the quieter waters of the vast but shallow Mediterranean Sea. In such a manner an amorphous organic ooze of the saprcpel type is being laid down at the present time in freshwater tarns and lakes in this and other countries. Such a mud, on consolidation, yields a brown regularly-foliated shaley peat, which yields hydrocarbons on distillation and burns with a bright luminous flame.

In the case of Kimmeridge Clay it is, however, not necessary to go far to find a likely source for the carbonaceous material enclosed within it. The formation is very rich in animal fossils, and is remarkable, not so much for the number of species represented, though the range of forms is very wide, as for the vast number of individuals enclosed in its strata. The sea must simply have teemed with life of every kind. In addition to various foramenifera and gasteropods and lamellibranchs of the shallow and fairly deep waters, there lived a large number of cephalopods, represented by the ammonites and belemnites—some of gigantic size. But the most striking fossils are the remains of the great reptiles of various types. They abounded at that time, dominating the waters, the land and the air in a way that no other single class has ever done. Lizard-like reptiles, the Plesiosaurians, inhabited the seas crawling out to bask on the shores. Fish reptiles, the Ichthyosaurians, occurred in vast abundance in the waters of the sea, there competing not only with the Plesiosaurians, but also with turtles and crocodilians. Gigantic land reptiles such as the Dinosaurians roamed the earth and found plenty of food in the great cycadean forests of the period, while above land and sea flying reptiles, the Pterodactyls, displayed some measure of mastery over the air. Most of the material of the carcasses of this vast concourse of life was doubtless again resolved into its elements by the ordinary agencies of decay, but it is surely not beyond chance that some at least became locked up within the mass of inorganic mud before the processes of decay had run their full course. Possibly locally within the depths of the central sea or at intervals in the course of a long period of time, conditions favoured the preservation of organic waste, preventing its decay, much as the decay of vegetable matter is soon arrested in the formation of peat, and enclosing it in an inorganic matrix.

The "coal" itself contains Upper Kimmeridgian fossils, and some, as species of oysters, were evidently the denizens of fairly shallow waters, while others similarly pelagic or littoral occur in the shale immediately below. The forms thus intimately associated with the coal cannot, however, be regarded as contributing, except in the slightest possible degree, to the bituminous material of the coal. The principal source of the oil was most probably the prolific and exuberant animal life of the higher types, chiefly the reptiles and fishes, though vegetable waste, marine and land, and derived coal mud, may also have added their quota.

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## The Chemistry and Theories of Origin of Oils.

By A. Teichfeld.

The Chemistry of Mineral Oils, comprising free petroleum oils and oils distilled from shale, has been considerably extended of recent years by research, both academic, as a result of theoretical speculations on the origin of the oil, and technological, under the necessity, in some cases, of removing deleterious impurities, chiefly sulphur.

Various theories on the origin of petroleum have been urged from time to time. Before discussing the most typical of these it appears well to premise some short description of the various groups of hydrocarbons composing petroleum. The chief are these:—

I. The Paraffins, or straight open-chain saturated hydrocarbons.

II. The Iso-Paraffins, or side chain saturated hydrocarbons isomeric with the first.

III. The Cyclo-Paraffins (Polymethylenes) or so-called Naphthenes, or ring, saturated hydrocarbons, sometimes considered as hydrogenated aromatic compounds, though not quite correctly so, for they range from 3-membered (Trimethylenes) up to 8 or 9-membered Carbon rings.

IV. The Aromatic Hydrocarbons of the Benzene series.

V. The Olefines of the Ethylene series, with one double bond in the molecule.

VI. The Di-Olefines with two double bonds.

These latter unsaturated hydrocarbons are found in natural mineral oils in only small quantities, but in oils obtained by the distillation of shales always in abundance. This is due to the occurrence of "cracking," i.e., the splitting the larger molecules undergo at high temperatures into smaller fragmentary molecules. The stability of the hydrocarbon molecule at high temperatures is roughly inversely proportional to the molecular mass. This phenomenon of cracking was first adequately investigated in the classic research of Thorpe and Young. (R.S. Proc., Vol. 19, p. 87, 1871), when by repeated redistillation at high temperatures under pressure pure paraffin wax was made to yield low-boiling liquid hydrocarbons, roughly half and half olefines and paraffins. Heusser (Berichte, Vol. 30, p. 2744), in a direct analysis of Scotch Shale oil, records 44 per cent. of Paraffins, 10 per cent. Naphthenes, 7 per cent. Aromatics and 39 per cent. Olefines. Pennsylvanian oils consist largely of paraffins, the Caucasian oils contain up to 80 per cent. naphthenes, while Borneo oils contain a fair proportion of aromatic hydrocarbons, a circumstance which makes them particularly valuable as the source of the basic-material of various high-explosives. This variety of composition may be ascribed in part to the different mother substances of the oil and in part to the diversity of local conditions of temperature and pressure under which the oils were conceivably naturally derived by distillation from the original bituminous sediments.

The chief theories of the origin of mineral oil and its immediate source, the bituminous shales, may be now briefly outlined. Perhaps the oldest theory on record is that published in 1791, by Balthasar Hacquet, an Austrian physician of French extraction, who for 23 years was professor of natural science in Lemberg and Cracow. It anticipates the generally accepted modern theory of Engler in concluding that the Galician oil originated by the dissolution of marine animals in sea water, oil and salt therefore being naturally in close vicinity. This theory probably displeased his contemporary, the Polish clergyman. Chr. Kluk, a noted mineralogist and zoologist, who in 1781 dismissed the possibility of an organic origin and developed a theory on a purely biblical basis; that the earth soon after the creation of man abounded in fats making life pleasant, which on the fall of man, were diminished in quantity to be still later scattered by the Flood to localities where mineral fats are now found.

Theories on the origing of Petroleum fall into two or three distinct types. I. *Cosmical theories*, which are almost entirely pure speculation with a very meagre basis of evidence. Sokolow, for instance, stresses the facts that absorption lines characteristic of hydrocarbons occur in the spectra of certain stars and that hydrocarbons occur frequently in meteorites. P. H. Bouligny, of spheroidal state fame, developed a theory in which he went so far as to suppose a sort of downpour of mineral oils in the form of rain.

II. *Inorganic theories* as to the origin of oils are chiefly represented by that of the great Russian chemist, Mendeleef (J.C.S., Vol. III., p. 28 (1877)), where he assumed the existence of iron carbides at some depth in the earth's crust which generated hydrocarbons in contact with percolating water. Both he and the French chemist, Cloez, who independently came to the same conclusion, synthesised petroleum-like hydrocarbons by the action of such simple re-agents as superheated steam and weak acids on various iron carbides. This carbide theory had many adherents, especially in the last decade of the 19th century, and much interesting laboratory work was done under its stimulus. Moissan produced carbides of practically all known metals with his electrical furnace and studied the action of water on them, obtaining a variety of hydrocarbons—uranium carbide for one yielding a mixture of liquid hydrocarbons.

Sabatier and Senderens in their classic research on hydrogenation by means of finely divided nickel as catalyst synthesised a petroleum-like substance from acetylene; this varied in composition, resembling either Pennsylvanian, Caucasian, Galician or Canadian oils, according to conditions of the reaction.

Another inorganic theory of a distinct type urges the likely origin of oil as a bye product of volcanic or solfataric action, but there being no trace of volcanic or solfataric action in Kimmeridge Clay this theory need not detain the present account.

III. The *Organic theories* fall into two sub-classes as the origin is sought among plants or among animals. Even before Hacquet's suggestion of the likely animal source of mineral oils Fr. v. Beroldingen, one of the founders of the modern theory of the origin of coal, ascribed the derivation of "earth-fats" to decayed vegetable substance. But while the most stable vegetable substance, cellulose, containing 49 per cent. of oxygen, is slowly converted into coal, the corresponding substance in animals, fat, contains 11 per cent. oxygen, and this would appear the most probable source of the bituminous matter in oil shales, and through this of petroleums.

The generally accepted theory of the organic origin is that of Engler, who considers the bodies of abundant fish and reptiles of the ancient seas to have been sufficient to supply the vast stocks of mineral oil and bituminous shale. Engler's experiments took the form of repeated distillation of fish oil made under some ten atmospheres of pressure, whereby he obtained fair quantities of oil with all the characteristic properties of crude petroleum—a brown colour, green fluorescence, etc., and containing 90 per cent. hydrocarbons. These experiments on fish oil as a likely source of petroleum had to some extent been anticipated by the work of two Americans, Warren and Storrer, who in 1859 obtained a petroleum by the destructive distillation of crude fish oil after saponification with lime. According to Engler's theory, during the decay of marine animals, taking place in a deficiency of water-dissolved air, all the protein substance was converted into gaseous or soluble matter, the fat alone remaining little diminished, if anything, in quantity.

A striking illustration of an intensified and wholesale destruction and decay of animal organisms, such as might have occurred during Kimmeridgian times, is given by the Russian geologist, Andrussow, in a description of the bay of Adshi Darja, on the eastern side of the Caspian Sea. This expanse of some 7000 square miles is connected with the main sea by a very narrow channel. Owing to the excessive evaporation going on over this "back water," not only is the salinity raised considerably above that of the Caspian, but a strong current is caused to run into the bay, carrying with it large quantities of the varied marine fauna, fish and plankton. The animals soon perish, some decaying in the waters and others on the open beach. So abundant is the mass of carcasses in spring that the sea-gulls then feed only on fish eyes.

Confirmatory of the opinion that animal remains are the ultimate source of petroleum is the discovery made by Donath of protein decomposition derivatives in bituminous shales from South Austria. Even stronger evidence is the presence in oils of optically active compounds affecting the plane of polarised light; these substances can only have been made by organised life.

The next step in the course of formation of petroleum, according to Engler's theory, appears to have been the saponification of the surviving fats and the conversion into a wax-like matter fatty acid—adipocere, the glycerine being carried off in solution by the water. This adipocere or carcass wax mixed with mineral sediments would form the bituminous shales, limestones and sandstones. In a still later stage the earth wax would gradually lose carbon di-oxide and be finally converted into the hypothetical mother substance of the oils—kerogen. The last stage of all would appear to be the slow distillation from this kerogen of the free oils and gases into the superincumbent absorbent sandstones and limestones, in which, under favourable conditions of folding, they remain until released by borings. Confirmatory of this last point is the occurrence of thick beds of oil shales underlying the extensive Appalachian oil-fields and of richly fossiliferous oil shales beneath the Galician oil-fields.

A further transformation of mineral oils yet remains to be briefly mentioned. Under favourable conditions oils rich in the unsaturated hydrocarbons readily polymerise and take up oxygen or sulphur to form bodies of higher molecular mass—the oxy- or sulphide-bitumens, of which asphalt is the best known. The introduction of sulphur into the hydrocarbon molecule may also be effected at an earlier stage, as during the transformation into kerogen. Perhaps the highly sulphurous kerogen of the Kimmeridge shale, from which the heavily charged sulphur oil is derived on distillation, is a sulphide-bitumen. If so, the difficulty so far experienced in reducing the proportion of sulphur is largely accounted for.

Though the controversy on the origin of bituminous shales and petroleum oils still rages between the supporters of the inorganic and the organic theories, it appears to us that the opinion that they owe their hydrocarbons in the first place to organised life and that of the animal kingdom has most to recommend it.

## The Chemistry of Sulphur in Mineral Oils.

For over two centuries various attempts have been made to utilise the Kimmeridge shales in one way or other, but as we shall see later, all have so far failed. The stimulus of the war has, however, revived interest in them again, so that in the course of the past two years four papers on the subject of Kimmeridge oil alone have been read before the Institute of Petroleum Technologists. It is felt that the vast potential resources of the Kimmeridge shale deposits could become a home supply that would contribute to a very considerable extent to the large demand for mineral oils in this country, if only the high percentage, some 5 to 8, of sulphur now found in the distillates could in some way be reduced to a reasonable limit. The history of the oil industry, generally, supplies several instances where similar problems after careful research have been solved and serious defects removed with complete success. Two extensive oil-fields, one in U.S.A., the Lima district in South-Western Ohio, and the other in Canada, between Lakes Huron and Ontario, were for a long time practically as useless as Kimmeridge shale still is here. The sulphur content of the oils from these fields is much lower than in Kimmeridge oil, averaging about 1 per cent. only. The bulk of the sulphur could be taken out by the usual refining methods, but a small residual portion of obstinately held sulphur for a long time defying all attempts at removal and causing offensive smells rendered the oil of little industrial value. Finally, H. Frash after careful research succeeded in solving the problem of removing the last traces of sulphur from these "skunk" oils, and to-day they are just as valuable as the ordinary Pennsylvanian products. Many other oils contain considerable proportions of sulphur, but no special difficulties have been experienced in their refining and they all yield good class distillates. As a matter of fact, strictly speaking, all mineral oils contain some sulphur, but mostly in very minute quantities, or such as can be removed by suitable processes.

The question of the origin of sulphur in oils and shales is closely connected with the theories of the origin of oils. In the process of the decay of marine animal matters the sulphur compounds formed by the decomposition of the protein constituents are converted into gaseous and soluble products and some of these, during the formation of liquid oils, may have interacted with the hydrocarbons, more easily the unsaturated, and so introduced sulphur into the oils. Where the oil or shale contains considerable quantities of sulphur a further mode of introduction from an outside inorganic source is probable during a secondary process. That gypsum, calcium sulphate, may be the source of the abnormal quantities of sulphur in the Kimmeridge shale oil occurred to the present writer, and it appears that the idea has also suggested itself to others in similar cases. An analysis of samples of Kimmeridge shale gave a value for Ca O (lime) at 12 per cent. and for S. at 6.5 per cent. : the ratio of Ca O to S. in gypsum is as 12 to 7; a very close agreement. Perhaps further work will show whether there is any firm basis for this suggestion.

In connection with this it is interesting to point out that Scotch shales contain very little Ca O (lime) and the oil but slight traces of sulphur. Partly as a further illustration, but more as a chemical curiosity connected with the subject, will be now quoted an old analysis as given in Burton Green's monograph of Kimmeridge shale.

Analysis of the Residue Shale or "Carbon"

| | | | |
|---|---|---|---|
| Soluble bone phosphate | 0.39 | Organic sulphate of lime | 5.08 |
| Burned animal matter | 4.85 | Sulphide of lime | 4.22 |
| Organic nitrogen | 2.95 | Silica | 4.59 |
| Phosphate of lime | 1.37 | Hydrogen | 7 |
| Carbon | 48.12 | Alkaline oxides | 5.15 |
| Vegetable matter | 12.50 | Naphtha | 3.55 |
| | | — | .04 |

Notwithstanding the inexplicable and curious items of the anaysis, one fact is evident, namely, the high proportions of the "sulphate" and "sulphides of lime." Dr. F. M. Perkin, in his valuable paper "Sulphur in Petroleum Oils" read at the Institute of Petroleum Technologists in March, 1917, called attention to a fact which illustrates the point now urged. He believed that it is generally found that larger amounts of sulphur are found in oils obtained from limestone regions than from those where the geological formation is siliceous.

## Types of Sulphur Compounds in Oils.

Several classes of sulphur compounds have been recognised and isolated from various mineral oils. Indeed practically all existing types of organic sulphur bodies are represented and one particular class, the thiophanes, were actually first isolated from some North Americal oil five years before some of them were synthetically prepared, and now practically the whole class has been synthesised and its generic properties fully investigated.

1. Elementary sulphur occurs dissolved in some Texas oils and separates as crystals in the tanks.

2. Hydrogen sulphide appears as traces in some Galician and Canadian oils.

3. Mercaptans or sulphur (thio) -alcohols are found in oils noted for their sulphur content, as the Persian, Mexican and Egyptian.

4 Alkyl-sulphides of thio-ethers and disulphides are noted for the difficulty attending their removal.

5 and 6. The last two definite classes to be mentioned are the thiophanes cited previously and the thiophenes. In the light of recent research on the synthesis of the thiophanes it appears that they are analogous to the homocyclic Cycloparaffins or Naphthenes mentioned earlier (p. 62) in this paper. The thiophanes are in fact heterocyclic paraffins in which the polymethylene rings are closed by sulphur. Just as the homocyclic naphthenes range from the 3-methylene ring up to 7 or 8 methylene rings, so the thiophanes range from 4-membered rings up to a 7-ring. (Grishkewitch-Trochimovski, Tourr. Russ. Phys. Chem. Soc., 1916). The thiophenes contain less hydrogen than the thiophanes, but so far all attempts made to hydrogenate the thiophenes to 5-membered thiophanes by the ordinary methods, using finely divided nickel or platinum, have failed, possibly as a result of the poisonous action sulphur has upon these catalysts. The thiophenes and the coupled thiophenes, the thiophthenes, form a class which is represented by small quantities in different oils. The tetra-substituted thiophenes may play a part in the chemistry of Kimmeridge oil and will be discussed more fully a little later.

One class of sulphur compounds still remains to be mentioned, which, though having no chemical designation of its own, always plays a very important part in the development of an oil field or shale deposit, as for example that of the Kimmeridge formation, until the problem of the nature of the sulphur compounds found in them is solved and the class can be placed amongst the known types or a new type made to receive it, as was the case with the thiophanes. This, the great class of undefined sulphur compounds holds the puzzle of the Kimmeridge shale. Research is now proceeding in several quarters, and no doubt ultimately the experiences of the Ohio Lima oils will be repeated in this country, and the Kimmeridge oil shale, from being merely a potential source of oil, will become an actual source.

Turning now to the question of the removal of the sulphur constituents from oils it must be borne in mind that the problem means the task in each case to find the proper key to fit a given lock. In other words research is necessary to find out what particular type of sulphur compounds constitutes the harmful impurities and then a suitable chemical treatment is adopted to remove them. At present the Kimmeridge oil question rests in the phase of research into the nature of the class of sulphur compounds that up to the present have prevented the adequate use of the shales.

In the refining of shale oils two different methods may be adopted: either the treatment of the oil after distillation or the treatment of the shale in the process of retorting. Numerous attempts have been made on Kimmeridge shale according to both methods, but so far no process has been devised to work on a manufacturing scale, though many encouraging and instructive results have been obtained. Several patents for the treatment of Kimmeridge shale have been taken out, of which three of the oldest will be briefly mentioned. The British patent 1882/3792 by E. K. Mitting uses superheated steam while retorting the shale, with the object of increasing the yield of ammonia and removing the pyridine which had been identified in Kimmeridge oils as early as 1854 by Williams. Another patent 1883/3725 by C. M. Irvine and R. Slater brings out nothing new and only claims to get the sulphur out of the noxious gases of the distillation by burning part and combining the $SO_2$ thus obtained with the $H_2S$ in the gases, so bringing about the liberation of the sulphur. The third patent by R. Irvine 1884/5933 is a very interesting one. Taking the point of view that sulphur easily destroys paraffin wax (cracking it and combining with the fragments and evolving $H_2S$ —) and that, therefore, Scotch shales, especially the poorest in sulphur, yield the greatest amount of paraffin wax and Kimmeridge shale little or none, he advocates the use of ammonia in the gaseous form or as the carbonate during the process of distillation for the purpose of increasing the yield of wax. The use of ammonia at high temperatures to desulphurise sulphur-laden oils constitutes the main idea of one of the more successful attempts of quite recent date, mentioned by Dr. F. M. Perkin (Inst: Petr: Techn: Vol. III., p. 238).

While working with sulphur-containing oils of nearly any description one fact of interest is noticed: $H_2S$ is always evolved during the distillation. One would at first think that when this gas escapes it signifies that sulphur is escaping from the oil and that we have only to augment the rate of evolution of $H_2S$ to solve the problem. This would be the case if it were not for the fact that the amount of hydrocarbons escaping simultaneously as permanent gas or uncondensible vapour remains in proportion, and consequently the percentage of sulphur in the gases is practically the same as in the oil and no improvement is obtained. It is, however, possible that here is the clue to the problem. As far as the research on Kimmeridge shale is concerned hundreds of experiments with all kinds of chemical treatment have been recently made, but without success. In some cases the percentage of sulphur has been brought down considerably, but the processes are too expensive for industrial application.

It is a well-known fact that by a suitably adapted hydrogenation, using the gas in the nascent state, the sulphur may be taken out of an organic molecule and converted into $H_2S$. The value of this type of hydrogenation was occasionally recognised long ago, and one of the earliest attempts to apply the principle to the removal of sulphur from oils was patented by M. Schiller (U.S.A. patent No. 580652, 1897). The same kind of hydrogenation was used in the earlier cited process of using ammonia at high temperatures, when it dissociates and yields hydrogen in the nascent state, which, acting upon the sulphur, brings about the desired augmentation of $H_2S$. Unfortunately the very elegant methods of hydrogenation by catalysis, in the presence of nickel, platinum or palladium, cannot be well applied in our case owing to the poisonous action of the sulphur on the catalyst. But even this side of the problem cannot be considered hopeless, and some antidote may yet be devised and the problem solved. Altogether, the elimination of sulphur from Kimmeridge oil by means of hydrogenation of one type or other appears decidedly promising. In some cases the hydrogenation by nascent hydrogen may be used to reduce a refractory sulphur compound to one more easily attacked by the usual refining methods.

Various methods are employed for eliminating sulphur by chemical methods. The main idea of those in actual use, after the determination of the kind of sulphur bodies present in the oil, is to adopt the proper chemical treatment to convert them into a gas or a solid or otherwise into a compound easily separated. The Frash process will serve as an example. When Frash began work in 1885, Ohio oil, owing to its sulphur content, was sold at 17 cents. a barrel, whereas Pennsylvanian oil fetched 2 dollars 25 cents. After two years' research he succeeded in developing his process. It consists essentially in treating the oil with copper oxide; this combines with the sulphur and can be readily separated as the sulphide which on roasting yields the oxide again for further use.

The chemistry of the action of inorganic sulphur compounds and elementary sulphur on hydrocarbons is practically as old as the development of organic chemistry itself. Recently this question has been taken up again. It is an extremely strange coincidence that in the last few years—the war period in fact—just when increased attention was being paid in this country to the sulphur question in connection with Kimmeridge shale derivatives, on the Continent, on the other side of the fighting line, some very interesting papers have been published on the action of sulphur on the different classes of hydrocarbons. These papers throw a very clear light on the Kimmeridge problem, and it is the purpose of the last few paragraphs of our present paper to give a short description of the work done.

We have already mentioned the cracking effect of sulphur on paraffins and how the unsaturated fragments resulting from the action take up some sulphur and produce sulphur compounds. About 1909 Engler took up the study of the action of sulphur on hydrocarbons in general. One of his pupils, E. Spanier, in his doctorate dissertation gives a very comprehensive survey of the whole question enriched by some instructive experiments carried out, no doubt, under Engler's advice. Heating the saturated hydrocarbon hexane with sulphur at high pressure and at 210°C., Spanier got practically no action; hexylene, the corresponding unsaturated olefine, was on the contrary much affected, only 2 per cent. unchanged hexylene being recovered, the rest being converted into unpleasantly smelling high boiling oils which constantly gave off $H_2S$ on distillation. Spanier noted that the sulphur compounds thus formed cannot be removed from the oils by ordinary refining methods. The continuation of Spanier's work is seen in three papers of W. Friedman. In numerous experiments he obtained well defined bodies such as thiophenes and thiophthenes as well as various large amounts of asphaltic polymerised high molecular bodies. Even more interesting from our point of view are other facts elucidated by Friedman. Considering the action of sulphur upon the whole series of the paraffin hydrocarbons it is found that sulphur has no action at about 200°C. on any hydrocarbon as far as heptane or octane, but beyond this point the higher the number of carbon atoms in the hydrocarbon molecule the more pronounced is the action. With unsaturated olefines, on the other hand, the action begins at the lowest member of the series, ethylene.

In most cases sulphur has the tendency to build up chiefly a 5-membered thiophene ring, partially or wholly substituted. The yield of thiophene obtained from normal octane was only 2 per cent., but from octylene, the corresponding olefine, it was 20 per cent. Friedman also refers to a paper by Bauman and Klatt, who found that by the action of sulphur on stilbene (diphenylethylene) a tetra-substituted phenyl thiophene, known as Thionessal, was readily obtained with a yield of 70 per cent. It is very evident how readily a thiophene ring is built up from larger unsaturated molecules by the action of sulphur. So pronounced is this tendency of sulphur that when $H_2S$ is used to interact with stilbene free hydrogen is liberated and thionessal formed. In addition a most interesting secondary action takes place. The liberated hydrogen, being in the nascent state, hydrogenises part of the stilbene to toluene (splitting the stilbene molecule into two), and more remarkable still, hydrogenises the thionessal in good yield to tetraphenylbutane, with elimination of sulphur. This indeed is a remarkable example of desulphurisation by hydrogenation. Other workers have obtained similar results by the hydrogenation of thionessal under different conditions. From and Achert in this connection call attention to the fact that tetra substituted thiophenes are very indifferent to chemical desulphurisers of the ordinary type, such as copper oxide and sodium, while Friedman quotes that they cannot be sulphonated, i.e., dissolved in sulphuric acid, and do not show the typical Indophenin reaction.

Scheibler has succeeded in isolating thiophenes from oils rich in sulphur obtained in the South of France to the extent of 50 per cent. The present writer is not aware that the research on Kimmeridge oil has revealed any such bodies in it, but it is quite possible that the tetra-substituted thiophenes, with their peculiar properties of refractoriness against chemical desulphurisers, may occur. At any rate the search for them offers a very inviting and may be profitable study, for it is just possible that it would show the way to reach the goal—the complete desulphurisation of the Kimmeridge oil that could be obtained in immense quantities in Dorset and the Midlands to the great advantage of the Empire, more particularly in time of war.

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# The Mining of Kimmeridge and other Oil Shales.

BY ALFRED J. G. SWINNEY.

The Empire is not fortunate in an abundance of liquid petroleum, yet the deficiency might be considerably met by a more extensive distillation of the bituminous shales of the Kimmeridge type, which occur throughout it in some considerable development. In the Home country in addition to the Kimmeridge shales occur the oil shales of the Lothians. In the Overseas Dominions bituminous shales are mined in Canada (New Brunswick, Nova Scotia, and Quebec), Australia (New South Wales and Queensland), and in South Africa (Transvaal). Petroleum, bituminous shales and coal represent the vast stores of solar energy absorbed in distant geological periods and long retained, upon which the existing type of civilisation, remarkable for its varied mechanical development is largely based. Hence their interest and importance.

The destructive distillation of bituminous shales for the purpose of obtaining tar and oil was sporadically practised for many centuries before the inauguration of the present methodical shale industry, some 70 or 80 years ago. It was first established in the 30's of the last century in connection with the shales on the western slopes of the Central Plateau of France, only to be soon overshadowed by the rapid and successful development of the Scotch oil industry established by the enterprising genius of James Young. Two early English patents are of historical interest in this connection. One was granted to Becker, a German, who, having successfully distilled coal in Holland, came over to this country in 1681 and took up a patent (No. 217) with Henry Searle. Another, No. 330, was granted in 1697 to E. Hancock and W. Portlock apparently in connection with the use of some bituminous shale in Shropshire. Unfortunately, though the specifications are full of details as to the protection afforded the patents, they are silent on the method of working the process.

The Kimmeridge shales even in Neolithic and early historic times appear to have had some value or interest to many. Doubtless the property of ready ignition was early noted and made use of, if not actually regarded with some awe and superstition. The ease with which the shale could be worked by rough tools, including a primitive lathe used by early man, made it a suitable material for making beads, vases, loom weights, and the peculiar bored discs, known as Kimmeridge coal money, which can be turned out not uncommonly from the barrows and earthworks in Purbeck and elsewhere. Wave-worn pebbles of the bituminous shale are still gathered on this Purbeck coast, and to some slight extent eke out the supply locally of ordinary coal; but their strong fumes absolutely prevent any very extensive use as fuel.

The first industrial use of Kimmeridge shale appears to have been made towards the end of the 16th century, when some works were erected for the extraction of alum, and later by Sir William Clavell for making glass and getting salt from sea water. In both cases a highly bituminous variety of the shale, blackstone, was used as fuel. The sulphuric acid necessary for the conversion of the clay into alum was derived by burning from the abundant quantity of sulphur contained in the shale. The use of the shale and blackstone was, however, attended with considerable inconvenience and indeed nuisance. In some legal dispute involving Sir Wm. Clavell it was stated "A kind of black stone that serves to burn for maintaining fire in the glass house, but in burning yields such an offensive savour of extraordinary blacknesse, that the people labouring about these fires are more like furies than men." The enterprise had to be abandoned and all that remained in 1748 was stated to be the ruins of buildings and heaps of ashes. The exploitation of these valuable deposits remained suspended until about 1850, when the first real attempt was made to utilise the shales to their full extent, as sources of oil and other valuable derivatives. Retorts and other necessary appliances were erected at Weymouth for the manufacture of naphtha, lubricating oil, grease and varnish, and the utilisation of the ammoniacal liquor for making fertilisers. Disaster awaited this undertaking also, as in addition to the company being involved in a lawsuit, arising out of a dispute concerning the process adopted, they were indicted for causing a nuisance, and finding themselves short of capital closed down in 1854. In the course of the case the judge remarked upon the oils as being "offensively smelling and unmarketable." The works then passed into the hands of another company and were removed to Wareham. This company specialised in the manufacture of various fertilisers and obtained quite a local

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A useful monograph, "Kimmeridge Shale, its origin. history, and use" (22 pages) by Burton Green, published about 30 years ago, though now out of date, may be thoroughly recommended to any one interested in the subject. A paper by J. Mansell-Pleydell in the Proceedings of the Dorset Field Club, Vol. 15, also contains much interesting information.

reputation. They did not neglect the recovery of the volatile matter, for it is on record that from one ton of shale they produced 7½ gallons of naphtha, 10 gallons of lamp oil, and 12½ gallons of lubricating oil, as well as a small quantity of wax; a very good yield. The life of this enterprise was unfortunately short, for after three or four years' working the company closed down. Yet another company stepped into the breach, and, taking over the plant, installed modern and complete machinery with a view of producing oil on a large scale. They were ambitious enough to contract to light Paris with gas, and undoubtedly imparted much energy into their work, producing some 50 tons of oil and 500 tons of fertilisers per month besides exporting about 1,200 tons of shale per annum. A light pier was erected in the bay in 1859 and work was commenced on the erection of a massive stone pier on the site of one erected some 200 years before. The company dissolved in 1872. Some three or four years afterwards an attempt was made to revive the exploitation of the shale, this time by the manufacture of Sanitary Carbon, but this proved a failure likewise. The many failures presented themselves to would-be adventurers as a sort of bogey, for nothing of importance has been done for the past 40 years. In 1914, however, a company was in course of formation to raise capital for the purpose, among other things, of working and distilling the shale seams at Brandy Bay, immediately to the west of Kimmeridge. To overcome the objectionable feature of the great excess of sulphur in the distillate their proposition was to mix the oil with other shale oil to be produced from much less sulphurous Irish deposits. The Great War prevented the proposal from maturing, though in the course of the war attention was directed to the urgent necessity of obtaining supplies of mineral oils from the home deposits of bituminous shales, of which those of the Kimmeridge Clay are among the most extensive.

At Ringstead, where is the next exposure of Kimmeridge Clay along the Dorset coast westwards, the cliff below Holworth House contains several layers of " coal," now for the most part obscured by talus and landslides and therefore rarely seen. This cliff was once better known as the " burning cliff " from the circumstance that here the coal caught fire spontaneously in 1826 and burnt for several years. It seems very probable that this fire originated by the self-oxidation of the iron pyrites, or more accurately the marcassite variety of iron sulphide, which is common in the clay. The fire caused little fumaroles emitting bituminous and sulphurous fumes with occasional deposition of sulphur.

Rich oil shales were reached by shafts and borings in the Portesham exposure betwen the Ridgeway and Weymouth by Mr. Mansfield in 1883, and a fair quantity of coal was sent to Scotland for distillation, though eventually little came of the enterprise. A coal seam was formerly dug for fuel towards the base of the cliff overlooking Portland Bay.

Several attempts to find coal seams in the outcrops in Oxford and Berkshire were made a century ago, but without result. The West Norfolk deposits, on the other hand, have recently been shown to be highly petroliferous. The results of the investigations made public by Dr. Forbes-Leslie are such as to justify sanguine hopes that a considerable and profitable oil industry might be started on the shores of the Wash, if the great rifficulty of the high proportion of sulphur could first be solved. Analyses of shale obtained in the neighbourhood of King's Lynn gave about 35 per cent. of volatile organic matter and some 14 per cent. of fixed carbon. The yield of oil per ton obtained on a commercial scale was some 40 gallons, though 50 gallons was obtained under laboratory conditions. In addition a ton of shale yielded sufficient ammonia to form 66lbs. of sulphate of ammonia in addition to 25,000 cubic feet of dry gas of high calorific and illuminating values.

The oil obtained had a high specific gravity, of between 0.942 and 0.960 and yielded on distillation 3.8 per cent. of its bulk up to 100°C; 5.7 per cent. between 100° and 170°C; 19.2 per cent. between 170°C and 245°C; and 39.2 per cent. between 245°C and 310°C. There was 0.8 per cent. of water and 31.3 per cent. pitch and tar. It will be seen that the proportions of the low-boiling hydrocarbons, suitable for motor engines, are considerable. The main point of interest in the bulk tests was the extremely low temperature at which the shales gave off most of their oil contents.

The Norfolk oil is very fluid, running almost like water. It is golden black in colour with a purplish tint with reflected light. The Dorset oil is more viscous and lighter.

The Kimmeridge coal according to an analysis of Dr. Hoffman, quoted by Mansell-Pleydell in his paper, has the following composition:—

| | | |
|---|---|---|
| Coke | | 43.0 |
| Mineral Matter | 23.5 | |
| Carbon | 19.5 | |
| Oily and Solid Volatile Products | | 39.0 |
| Light Oil | 2.3 | |
| Heavy Oil | 36.7 | |
| Gas, Water, Ammonia, etc. | | 18.0 |
| | | 100.0 |

According to the same paper one ton of Blackstone yielded 11,300 cubic feet of purified gas of high illuminating value and 817lbs. of coke. The volatile matter was about 73 per cent., leaving only 27 per cent. of ash behind.

The great difficulty so far attending the profitable use of the blackstone is plainly not the lack of bituminous substance but the high proportion of sulphur which is held in a peculiarly intractable state of combination both in the shale and the oil. This sulphur causes not only the abominable odour on burning but also the evolution of acid fumes of the oxides of sulphur which, more than being intolerable to men attending boilers where the oil might be used as a steam raiser, have also a serious corrosive action upon the metal. The same corrosive action on cylinders of internal combustion motors is also an effective bar to the use of the lighter fraction of the oil in ordinary industrial practice. Unless the amount of sulphur can be considerably and economically reduced in Kimmeridge Oil, or alterantively an alloy of iron which is not corroded by acids used in explosion engines, the vast potential wealth of the Kimmeridge Clay cannot become actual.

## The Oil Shale Industry in General.

Scotland must be regarded as the birthplace and home of Petroleum production from shales. In 1849 a thin stream of oil was observed oozing from the shale measures of the Carboniferous formation at a colliery near Alfreton, in Derbyshire. A close examination of this occurrence and experiments with the oil led to the idea that on the failure of these small springs of natural oil it might be possible to produce it in quantity from the seams of bituminous coal by a low temperature distillation process. The first efforts were highly successful, and upon the discovery of the deposits of Torbanite or Boghead mineral in Scotland about 1850 attention was directed to it in preference to the bituminous coal. On the exhaustion of the torbanite about 1862 the Lothian shale deposits were utilised, and have been actively mined and treated from that date to the present. The Scottish shales occur in a somewhat broad and well defined belt to the west of Edinburgh, and are developed on both sides of the Forth in a series of rocks designated Calciferous Sandstones. Their geological position is in between the Lower Carboniferous and the Upper Red Sandstone of the Devonian system. Interstratified with the Sandstone are a dozen or more seams of oil-shale, varying in thickness from 4 to 12 feet and yielding from 20 to 30 gallons of oil and from 20 to 60 lbs. of Sulphate of Ammonia per ton. The total output probably now exceeds three million tons of shale per annum, yielding roughly 18 million gallons of crude oil, from which nearly a million gallons of motor spirit are obtained. It is, however, the large yield of the sulphate available for fertilisers that has maintained the industry in face of the keen competition with the American oils.

In Ireland, at Bally Castle in County Antrim, close to the coast, some seams of rich cannel coal occur which have yielded 50 gallons of crude oil per ton on a manufacturing scale. It was from this source that it was intended to produce oil to mix with that of Kimmeridge, with a view to reduce the percentage of sulphur.

The Oversea Dominions of the Empire have had the exploitation of petroliferous shales in active operation for a number of years. In New Brunswick, Canada, a considerable tonnage of shale was mined and exported for distillation during the middle decades of last century, before the discovery of the Pennsylvanian oils killed the industry. Here the oil shales form part of the Upper Devonian, and so nearly correspond in point of age with the Scotch shales. The Kerosene oil shales of New South Wales were discovered as early as 1824, and since 1860 mining and distillation have gone on actively. These seams of Boghead mineral vary in thickness between 3 and 5 feet and carry as much as 150 gallons of oil per ton. Their geological position is in the Permo-Carboniferous strata, and their origin is referred to low organic forms, chiefly algæ. New Zealand also gives promise of developing valuable oil shale deposits. At Orepuki, South Island, a seam 4 feet in thickness carries on the average 32 gallons of oil per ton and gives a high yield of sulphate of ammonia. Oil shales are also worked in the Middleburg Carboniferous area in the Transvaal, where a good payable seam 5 to 7 feet in thickness, yielding per ton about 30 gallons of oil and 70 lbs. of sulphate of ammonia, has been located.

*Physical Features and Composition of Oil Shale.*

The word "shale" is somewhat of a misnomer and a little misleading. As applied to Kimmeridgean and similar beds it is quite correct, but when used to imply the petroliferous minerals of the type of Boghead Mineral and Torbanite associated with the Carboniferous system, it conveys a wrong impression so far as the physical structure of the mineral is concerned. The shales proper are laminated, with distinct bedding planes, and split easily, whereas Torbanite is quite homogeneous and massive.

Shales as they are mined are generally classed under one of three categories: curly, plain or paper shales. "Curly" is the richer and most valuable variety, generally dark brown in colour, fairly homogeneous, breaking with a more decided conchoidal fracture than other kinds, and resisting weathering to a marked degree—practically remaining unchanged by exposure to the weather for years. The "plain" shale, which forms the bulk of that treated at the present time, is lower in hydro-carbons than the curly variety and has more evident lamination and does not weather so well. The "paper" variety, as the name indicates, resembles very thin layers superimposed one another, united by subjection to great pressure. They split quite easily and do not weather well.

The Dorset Kimmeridge coal is chiefly brown in colour and plainly laminated. Some varieties, on exposure to the weather, separate into curly layers, while others remain unaltered after long exposures. It is light, though varying in density according to the amounts of inorganic ash. When struck it emits a wooden note. It feels somewhat unctuous to touch, and when rubbed its scent is mixed earthy and asphaltic.

The Norfolk varieties appear to be two: those of the Upper Series and of the Lower. The former variety is a rather close-grained rock, dark brown in colour, splitting along the bedding planes into thin laminæ, but with distinct planes of fracture. The shale is highly elastic. The latter variety is a greenish-blue rock less apt to split into thin laminæ but prone to fracture into small blocks. Both kinds of shale show an open texture, being more or less vesicular. When viewed under the microscope they are seen to consist, in the main, of a yellowish resinous substance with, in addition, narrow wedges of carbonaceous matter and lens-shaped masses of a lighter-coloured organic substance. The resinous substance which forms the greater part of the bituminous material of the Norfolk oil shale is composed of two distinct substances which differ in appearance, refractive indices, etc. Both substances suggest a gelatinised scum. Inorganic grains occur, mostly of silicates of alumina with iron, potash and water, such as glauconite, which, however, is not so common as in the Dorset oil shales. The Dorset oil shales show a general resemblance to those of Norfolk, though according to Forbes-Leslie in the case of the former the outline of the bedding planes is more distinct and has a wavy contour with an almost entire absence of the waxy material present in the Norfolk shales. The Dorset shales have been more compressed than the Norfolk shales, possibly by the mid-tertiary disturbances which caused the local Purbeck Anticline and the wider Hampshire and London Synclines, and Weald Anticline; if not also by the cretaceous disturbances. (The Norfolk Oil Shales. W. Forbes-Leslie, Bourn Inst. Petrol. Technologists. Vol. 3, No. 9 (1916), pp. 3-35.)

## *Shale Mining and Recovery of Contents.*

Shale mining is carried on in exactly the same manner as the mining of coal. In the neighbourhood of Kimmeridge the shale was won by means of adits driven into the hillsides or, as near Clavell's Hard, into the cliff face, or of shafts sunk through the unproductive beds. According to Mansel-Pleydell the process of distillation was as follows: The retorts were charged with about 5cwt. of shale previously broken into pieces 2ins. square, and the temperature maintained as nearly uniform as possible. The crude oil stood in tanks for 48 hours to let the ammonia-water subside, and was then passed into a still. The first product was a light oil, the second was a heavier oil containing paraffin.

Mansel-Pleydell quotes a more detailed account by Dr. Ure of the oily distillate. Various fractions were recognised. No. 1 was an offensively-smelling dark brown oil, suspended in a watery liquid and charged with sulphuretted hydrogen, ammonia and carbon dioxide. No. 2, when purified by treatment with nitric acid, which dissolved part, gave a light, colourless oil resembling petroleum. The soluble part was largely composed of benzene and possibly its homologues. The tar-like residue remaining after distillation at low temperatures gave, on heating to a high temperature, other volatile products, some rich in sulphur.

In modern well-established works the oil shale is heated in retorts to about temperatures between 900° and 1300° Fahr. The result is the liberation of (i) gas, which is stored and used for heating and illuminating purposes on the works; (ii) crude oil, which is pumped into tanks and afterwards refined; (iii) naphtha or petrol; (iv) ammonia water, which is distilled and treated for the manufacture of sulphate of ammonia; and (v) spent shale, consisting essentially of silicate of alumina with 2 to 3 per cent. of fixed carbon. The crude oil as it comes from the retorts is of a dark colour with a specific gravity of between .90 and .95. Refining, or, as it is technically termed, "fractionising," is really subjecting the crude oil to the application of heat at varying temperatures in closed retorts of special construction, by which treatment the portions of oil vaporising at different temperatures are driven off and recovered as separate and distinct units.

The first distillate is Petrol or Benzene. As the heat is increased and the necessary temperatures are reached to volatilise the respective grades of oil it is desired to produce, there come over in rotation (i) illuminating or lamp oil, (ii) gas or solar oil, (iii) lubricating oil, (iv) fuel oil, and (v) paraffin wax, leaving (vi) still coke or a residue. These oils, as produced, are subjected to further treatment with sulphuric acid, caustic soda, and other re-agents for purification, according to the nature of the deleterious impurity. With respect to sulphur it is generally recognised that the higher grade oils should not contain more than 0.6 per cent of sulphur, and lubricating and fuel oils not more than 0.76 per cent. In addition to distillation and "fractionating," another process, known as "cracking," is also employed. This practically means the redistilling of the oils at temperatures higher than the normal boiling points of the intermediate constituents, and so breaking up the molecules of the constituent hydrocarbons into lighter and more valuable fractions. In this way the yield of both petrol and burning oil from the crude petroleum is greatly increased.

### *Economic Importance of Mineral Oils.*

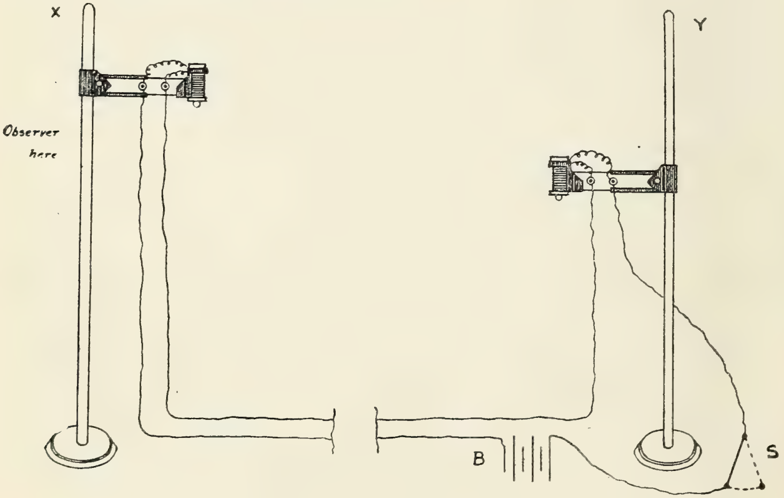
The development that has taken place in the petroleum industry since it was first inaugurated on a large commercial scale by Young in 1849 has been little short of marvellous. It still continues, and betokens the possibility, within a very short period, of the existence and world status of a Power depending largely upon its uncontrolled supply of hydrocarbon products. At first sight it is scarcely conceivable that so much of prime importance to the industry of a State should depend upon the supply of petrol, paraffin oil, lubricants, etc. Yet so it is; and the British Empire, not containing much oil-bearing deposits within its borders, is largely beholden to the goodwill of other nations and Powers for a sufficient supply of this prime necessity of modern industry. The general position of affairs is not one that can be considered entirely satisfactory, especially in times of war. It is now recognised that the position should be to some extent safeguarded by the utilisation of the extensive beds of bituminous shales found in different Dominions throughout the Empire, and at home of the Kimmeridge oil shales. From home sources the amount that could be raised would never, under ordinary circumstances, serve our daily requirements, but would perhaps serve for the national military needs if the overseas supplies were cut off by submarine warfare.

# The Velocity of Sound.

By HUBERT PAINTER, B.Sc., F.C.S.

(Read before the Physical Section, June 12th, 1917.)

The velocity of sound in air can be calculated with great accuracy from theoretical considerations and it has frequently been measured experimentally. The classic experiments essentially consist in determining by some form of chronograph the time taken by a sound, generally the report of a cannon, in travelling over a carefully measured distance of several miles. Thinking it desirable to have a method of making a direct measurement (indirect methods are already in use) that could be easily carried out in any building possessing a long corridor, I have devised the simple apparatus now before us.



It consists of a pair of small electro-magnets, bar-shaped, each fastened to a strip of wood. These wooden strips can be clamped at any desired height, each on one of a pair of upright stands about 4ft. high, and, when so clamped, the pole faces of the magnets are horizontal. The stands are placed on tables at the ends of a long corridor or passage or out-of-doors in a quiet spot. An electric circuit is arranged, including the two electro-magnets, in series, one or two dry cells and a switch. Two small steel balls are also required. Clamp the magnets so that they are at the same height above the tables, switch on the current, and put a ball on the downward-facing pole of each magnet. If two or more "listeners" take up a position behind one of the stands and the "operator" switches off the current, the balls drop simultaneously and, as they have fallen from equal heights, they reach the tables at the same instant. The two sounds, however, will not be heard simultaneously by the listeners, but that from the more remote ball will lag behind the other by the time required for sound to travel through the distance between the stands. The operator now raises the clamp on the stand nearer to the listeners and the experiment is repeated again and again until the listeners judge that the two sounds reach them at exactly the same instant. The nearer ball has to fall through a greater distance and the excess of time required is equal to the time that sound takes to travel through the distance between the stands. The calculation is simple. Let $h_1$ and $h_2$ be the heights through which the balls have to fall, and let d be the distance between the stands. Then if $t_1$ and $t_2$ be the times of fall, we have

$$h_1 = \tfrac{1}{2} g t_1^2 \text{ or } t_1 = \left(\frac{2h_1}{g}\right)^{\frac{1}{2}}$$

$$\text{and } h_2 = \tfrac{1}{2} g t_2^2 \text{ or } t_2 = \left(\frac{2h_2}{g}\right)^{\frac{1}{2}}$$

g, as usual, is the acceleration due to gravity.

The velocity is then given by the equation

$$v = \frac{d}{t_1 - t_2}$$

The accuracy to be expected is not great. It depends upon the listeners' powers of distinguishing between sounds that are and sounds that are not, perfectly simultaneous. With a little practice this, according to my experiments, can be done to about 1-100th of a second. Thus, if the distance d is about 110ft. the error may amount to about 10 per cent.

The first experiment with the new apparatus was performed on March 29th, Miss Marcia Penrose and Miss Frances Penrose acting as listeners. The heights from which the balls were dropped were 30.9 and 20.1 inches respectively and the distance between the stands was 75 feet 2 inches. These figures give a velocity of 986 feet per sec., instead of 1,114, the velocity corresponding to a temperature of 12°C. The error is about 11 per cent.

Putting the stands side by side on the same table the apparatus may be used for comparing the degrees of delicacy with which different persons can detect small departures from simultaneity in the case of two similar sounds. The few experiments hitherto done seem to indicate that this delicacy of discrimination is greater in young than in middle-aged or elderly persons.

# A Supplement

TO THE

# GUIDE TO THE FUNGI AND MYCETOZOA OF THE NEW FOREST.

By J. F. Rayner, F.R.H.S.,
Member of the British Mycological Society.

THIS Supplement enumerates 216 Fungi and 10 Mycetozoa, additional to those of the "Guide," published in 1911, bringing the total Forest list up to 909 Fungi and 60 Mycetozoa. Of the present additions no fewer than 164 Fungi and 9 Mycetozoa were recorded during the second visit of the British Mycological Society, which took place in the autumn of last year, 25-30 September, 1916, when a total list of upwards of 500 Fungi and 15 Mycetozoa was compiled. The remainder are due to local work. A large proportion of the new records are species of great interest, being rare—three new to Britain—or only recently distinguished. For definitions of some of these I am indebted to Miss A. Lorrain Smith, F.L.S., President, Mr. Carleton Rea, B.C.L., M.A., Hon. Secretary of the Society, and Miss E. M. Wakefield, F.L.S., of the Royal Botanic Gardens, Kew. I have also to thank Mr. W. J. Lucas, B.A., for help in tracing derivations of names.

Precise localities for the species taken during the Society's foray were not noted, but only the general direction of the daily excursions from Lyndhurst, in the course of which they were found.

These are denoted by initials, viz. :—

B. = Brockenhurst, including Park Ground Inclosure.
C. = Christchurch, including Lyndhurst Hill to Mark Ash.
E. = Emery Down.
L. = Lyndhurst Road Station, including White Moor, Rushpole Wood, and Busketts.
M. = Minstead.
R. = North of Racecourse.

J.F.R.

Southampton,
December 1, 1917.

## FUNGI.

### BASIDIOMYCETES.

[**Amanita verna** (Lom.) Fr. (syn. *A. virosa* Fr.) (Lat., of spring).
Formerly recorded as *A. virosa* for the Lyndhurst district; now found to be of universal occurrence in the Forest. Known by the glutinous, somewhat umbonate pileus, woolly stem, and thick, wide, lax volva.]

**A. porphyria** (A. and S.) Fr. (Gr., purple, dark, in allusion to the ring).
B., L. In woods. Poisonous. Akin to *A. phalloides* and *A. mappa*, but much smaller; ring brownish.

**A. recutita** Fr. (Lat., circumcised, from the volva).
B., L., R. Chiefly in pine woods. Poisonous. The volva is very distinctly cut round close to the base of the stem.

**A. strobiliformis** Vitt. (Lat., shaped like a pine-cone, from the scales).
Costicles. In grass ride. Edible and delicious. Known by its large persistent, angular warts. Colour usually pale tan or greyish. Massive.

**A. excelsa Fr.** (Lat. lofty; it is long-stemmed).
B., E. Grassy places in woods. Reputed poisonous. Brownish-grey, centre darker. Warts irregular, evanescent. Comparatively slender.

**Amanitopsis nivalis** (Grey.) Rea. (Lat., snowy).
Generally distributed. Entirely white. Usually regarded as a variety of *A. vaginata*.

**Lepiota holosericea** Fr. (Gr. and Lat., wholly silky, from the surface of the pileus).
Brockenhurst Park. Cultivated ground, etc. Edible. Cream colour.

**Armillaria mellea** (Vahl.) Fr. var. **tabescens** (Scop.) Rea & Ramsb. (Lat., wasting away).
L. "This is the ringless form of *A. mellea*, and by some authors referred to a distinct species as *Clitocybe tabescens*." (Rea).

**Tricholoma ustale** Fr. (Lat., of the colour of burnt cinnabar).
B. Under pines. Resembles *T. flavobrunneum*, but slenderer, no smell, etc.

[**T. immundum** Berk. (Lat., dirty, from the stained pileus).
L. In short grass. Small, dingy white; gills greyish. "Undoubtedly *Clitocybe fumosa* (Pers.) Bres." (Rea); already recorded under this name.]

**T. murinaceum** (Bull.) Fr. (Lat., of mice, perhaps from the smell).
Hawkhill. Under trees. Grey. Pileus cracking; stem with small dark scales.

**T. lixivium** Fr. (Lat., of lye, from its colour).
Busketts. Under trees. Small. Brownish, umbonate; gills grey-tan.

**Collybia lancipes** Fr. (Lat., spear-foot, from the shape of the stem.)
C. On the ground. Allied to *C. fusipes*, but differing in the radiately rugose pileus, and in being solitary.

**C. distorta** Fr. (Lat., twisted, from the stem).
R. On rotten pine-trunks, etc. Allied to *C. fusipes*, but closely resembling *C. butyracea*. Known by the broad pileus, thin, contorted stem, and gills becoming spotted.

**A. leucomyosotis** Cke. & W.G.S. (Gr., white *Myositis*, because it resembles *Naucoria Myosotis*, but is white-spored).
L. On bog-moss. Strong scented; gills adnate, sinuate.

**C. confluens** (Pers.) Fr. (Lat., flowing together, from the habit.
C. Marlborough Deeps. Among leaves. Near *C. hariolorum*, but grows in troops; stems wholly covered with white down; pileus thin, flaccid.

**C. tuberosa** (Bull.) Fr. (Lat., *tuber*, a tumour, referring to the sclerotium.)
Mark Ash, C., L. Among moss, etc.

**C. aquosa** (Bull.) Fr. (Lat., humid, from its hydrophagnous pileus).
C. L. Damp woods, etc. Edible. Near *C. dryophila*, but every part honey-colour.

**Mycena pseudopura** Cke. (Gr. and Lat., false *pura*, because like that species.)
Near Rhinefield. Under trees.

**M. plicosa** Fr. (Lat., *plico*, fold, from the pileus).
R. Among short grass, etc. Resembles *M. metata*, but pileus sulcate and stem not lax.

**M. plumbea Fr.** (Lat., leaden).
C., L. Pileus and stem ash-grey, powdered, gills horizontal.

**M. stylobates** (Pers.) Fr. (Gr., the base of a pillar.)
B. On dead twigs. Known by the radiately striate disk at base of stem.

**Omphalia philonotis** (Lasch) Fr. (Gr., loving damp.)
B. In swamps and on rotten wood. Dark, deeply infundibuliform, gills grey.

**O. fibula** Fr. var. **nivalis** (Fl. Dan.) Maire. (Lat., snowy, from its colour.)
B., L. Amongst short grass.

**Pleurotus ulmarius** (Bull) Fr. (Lat., of the elm).
Brockenhurst. On trunk of elm.

**P. acerosus Fr.** (Lat., of chaff or husks, from its growing among dead leaves.)
B. On the ground. Small, greyish, gills crowded.

**Hygrophorus Clarkii** (B. and Br.) W.G.S. (In honour of J. A. Clark).
Perry Wood. Setley. Setthorns. Amongst grass. Pileus and stem grey, viscid; gills broad, white; fragile.

**H. Reai** Maire. (In honour of Mr. Carlton Rea.)
C. Amongst grass. Pileus red, stem paler, viscid, taste bitterish.

**Lactarius helvus** Fr. (Lat., light bay, almost yellow.)
B. Damp mossy places. Known by the peculiar colour and downy stem.

**L. picinus** Fr. (Lat., pitch-black.)
B. In swampy ground. Dark, resembling *L. fuliginosus*, but umbonate, milk unchangeable.

**L. lilacinus** (Lasch) Fr. (Lat., from the colour.)
L. In woods. Small, fragile. Milk white, copious, unchangeable.

**L. volemus.** (Lat., a certain large pear.)
Whitley Wood. L. In woods. Edible. Golden tawny, large.

**Russula chloroides** (Krombh.) Bres. (Gr., pale greenish.)
B., C., L. In woods. Gills and apex of stem greenish. Distinct from *R. delica*, which has a white pileus, becoming spotted, narrower, white gills, etc.

**R. rosacea** (Pers.) Fr. (Lat., from the colour.)
Woodhurst. B. In woods. Resembles *R. sanguinea*, but gills broader and not decurrent.

**R. mustelina** Fr. (Lat., weasel-coloured.)
B. In woods. Pileus brownish, firm; stem and gills white.

**R. atropurpurea** (Krombh.) Maire (syn. *R. purpurea* Gill, etc.). (Lat., black and purple or red.)
B. Pileus deep blood-red, almost black at disk; stem white, sometimes stained ochraceous, sometimes rosy in middle; base ochraceous; gills white thin yellowish, nearly free.

**R. fallax** (Schaeff.) Fr. (Lat., deceptive, from its contradictory affinities.)
B., C., M. Formerly recorded as *R. fragilis* var. *fallax* Cke.

**R. punctata** (Gill.) Maire. Lat., spotted, from the frequently granular pileus.)

B., S. Amongst grass. Edible. Pileus rosy, etc., often with darker pointed warts; stem mealy, coloured or white. New (1916) record for Wimbledon Common, Wyre Forest, and New Forest.

Var. **violeipes** (Quél.) Maire. (Lat., violet-stemmed).

B. Differs from the type in the citron-yellow pileus sometimes tinged with lilac, and the white tinged with lilac, or lilac stem. New (1916) record for Wimbledon Common and New Forest.

**R. aurata** (With.) Fr. (Lat., golden.)

E. In woods. Flesh and edge of gills citron-yellow.

**Marasmius porreus** (Pers.) Fr. (Lat., leek-like, from the odour.)

L. Among leaves. Pileus striate, gills distant, yellowish.

**M. splachnoides** (Hornem.) Fr. (Gr., like *Splachnum*).

Whitley Wood. On pine leaves. Pileus whitish, pale tan in centre; stem slender, horny, reddish, abruptly penetrating support.

**Lenzites saepiaria** (Wulf.) Fr. (Lat., *saepes*, a hedge.)

Busketts. On pine wood. Pileus red-brown; gills yellowish, branched and *Daedalea*-like.

**Entoloma repandum** (Bull.) Fr. (Lat., turned up.)

Fletchers Thorn. Amongst grass. Pileus pale ochraceous, conical then expanded, small.

**E. Bloxami** Berk. (In honour of Rev. A. Bloxom.)

B. In open pastures. Pileus compact, campanulate, blackish-blue, stem solid.

**E. ardosiacum** (Bull.) Fr. (Gr., *ardein*, to irrigate, from its habitat.)

Setley Common. Amongst grass in wet places. Fragile, steel-blue, stem hollow, base white.

**E. speculum** Fr. (Lat., a looking-glass, from its glossy surface.)

B. Amongst grass, etc. Known by its shining white pileus and stem when dry.

**Nolanea proletaria** Fr. (Lat., prolific or common.)

C. Differs from *N. pascua* in the greyer cap, etc.

**Pholiota aegerita** (Brig. (Fr. Gr., *aigeiros*, the black poplar.)

Brockenhurst. On poplars, etc. Edible.

**Inocybe concinnata Fr.** (Lat., neat.)

B., L. In woods. Small gills, pileus brown, scaly, and **stem** brownish violet.

**I. petiginosa** (Fr.) Quél.) (Lat., scabby.)

B. In woods and shady places; small pileus, silky; gills **at first** yellow.

**I. duriuscula** Rea. (Lat., somewhat hard.)

B. Grassy places in woods. Large, firm. Gills with decurrent teeth.

**I. fulvella** Bres. (Lat., somewhat tawny.)

B., E. In woods and shady places.

**I. trechispora** Berk. (Gr., with the spores rough.)

L. In woods. Somewhat resembling *I. geophylla*, but umbo dark.

**Hebeloma sinuosum** Fr. (Lat., sinuous.)

C. In woods. Large pileus, misshapen, crenulate margin exceeding gills.

**H. ischnostylum** Cke. (Gr., thin pillar, i.e., stem.)

Busketts. On the ground. Small, whitish, or yellowish tan.

**Flammula hybrida** Fr. (Lat., mongrel, hybrid.)
Park Ground Inclosure. On stumps. Pileus orange-red. Stem with ring near apex.

**Naucoria escharoides** Fr. (Gr., scab-like, referring to the scales.)
E., L. On moist ground. Pileus pale tan, scurfy; stem flexuous.

**Galera spartea Fr.** (Lat., made of broom, from the rigid stem.)
B. Among moss, etc. Like *G. tenera,* but smaller; pileus more expanded, etc.

**Tubaria crobula** Fr. (Gr., a knot of hair.)
L. Among sticks. Known by its woolly scales.

**Crepidotus alveolus** (Lasch) Fr. (Lat., a small hollow or trough; the pileus turns up.)
E. On old stumps.

**C. mollis** (Schaeff.) Fr. (Lat., soft, from its substance.)
Brockenhurst Park. C., L. On rotten trunks, etc.

**Cortinarius (Phleg.) multiformis** Fr. (Lat., of many shapes; it is very variable.)
B. In woods. No violet tinge; gills serrulate, at first whitish.

**C. (Phleg.) caerulescens** Fr. (Lat., almost azure.)
B., C., L. Among moss in woods. Smaller than *C. purpurascens;* not spotted, not changing colour when broken.

**C. (Phleg.) fulgens** (A. & S.) Fr. (Lat., shining, conspicuous.)
B. In woods. Very showy, robust, tawny-golden.

**C. (Phleg.) decolorans** (Pers.) Fr. (Lat., becoming deprived of its colour, from the gills soon losing their purple.)
Perry Wood South. Under pines. Pileus persistently yellow; stem white, slender, attenuated, not bulbous.

**C. (Myxacium) mucosus** (Bull.) Fr. (Lat., full of mucus; it is very viscid.)
C. Under pines. Allied to *C. collinitus,* but stem even.

**C. (Myx.) vibratilis Fr.** (Lat., somewhat glittering, from the pileus.)
B. In woods. Pileus golden. Stem white, ringed.

**C. (Dermocybe) albocyaneus** Fr. (Lat. and Gr., whitish sky-blue.)
Park Ground Inclosure. Under beeches. Resembles *C. (Ino.) alboviolaceus,* but pileus not gibbous, etc.

**C. (Telamonia) bivelus** Fr. (Lat., two-veiled.)
Busketts Wood. Under trees. Stem sheathed with woolly scales.

**C. (Tela.) bulbosus** (Sow.) Fr. (Lat., bulbous—the stem.)
B. In woods. Resembles *C. brunneus,* but dwarfer; stem pink, distinctly bulbous, etc.

**C. (Tela.)gentilis** Fr. (Lat., of the same race: native.)
B., R. In pine woods. Near *C. hinnuleus*; smaller, ring yellow, oblique.

**C. (Tela.) periscelis** Fr. (Gr., garter, from the ring.)
L. In swampy places. Pileus and stem lilac, with several brownish rings.

**C. (Tela.) stemmatus** Fr. (Gr., wreathed.)
B. In moist woods. Bright bay, hoary at margin.

**C. (Hydrocybe) privignus** Fr. (Lat., a step-son.)
Busketts. In pine woods. Stout, firm; pileus pale tan, with hoary bloom.

**C. (Hydro.) dilutus** (Pers.) Fr. (Lat., diluted, weak, from the pileus soon losing colour.)
Busketts. In woods. Like *C. armeniacus,* but smaller; soft and fragile.

**Paxillus atromentosus** Fr. (Lat., covered with black wool—the stem.)
Ironshill. On pine stumps.

**Agaricus purpurascens** Cke. (Lat., purplish—the pileus.)
L. In woods, etc. Distinguished from *A. arvensis* by smaller size and coloured cap.

**Stropharia coronilla** (Bull.) Fr. (Lat., small crowned.)
B. By waysides. Habit of *Agaricus*, but gills not free.

**Hypholoma elaeodes** (Paul.) Fr. (Gr., like an olive—the gills.)
Denny Inclosure. On trunks, etc. Known from *H. fascicularis* by stem becoming rusty and gills greenish, then olive-coloured.

**H. pilulaeforme** (Bull.) Fr. (Lat., shaped like a little ball.)
B. On mossy trunks. Like a diminutive *H. appendiculatus*, but gills more flesh-coloured.

**Bolbitius tibubans** (Bull.) Fr. (Lat., tottering, from its delicate stem.)
B. Among grass. Pileus yellow, conical then plane, gills very narrow, stem slender.

**B. vitellinus** (Pers.) Fr. (Lat., of the yolk of an egg, from the colour.)
C. On horse dung. Pileus egg-yellow, stem with white scales.

**Coprinus sterquilinus** Fr. (Lat., dung-pit, from its habitat.)
Near Rhinefield. On horse-dung. Edible.

**C. extinctorius** (Bull.) Fr. (Lat., *extinctor*, an extinguisher, from the shape.)
Casticles. On the ground about roots of trees. Stem smooth, rooting.

**C. fimetarius** (Linn.) Fr. (Lat., of dung, from its habitat.)
Holmsley. On dung. Stem with fine scales.

**Gomphidius maculatus** (Scop.) Fr. (Lat., spotted.)
B. In woods. Pileus white, then variegated with black.

**Boletus rubinus** W.G.S. (Probably from Lat. *rubeo*, to be red.)
Aldridge Hill Inclosure. In grass in woods. Tubes wholly carmine, flesh yellow.

**B. parasiticus** (Bull.) (Lat., parasitic.)
Wootton Copse Inclosure. On *Scleroderma.*

**B. raticulatus** (Schaeff.) Boud. (Lat., netted.)
L. On ground under oaks. Easily distinguished from *B. edulis* by its paler, tomentose pileus, and stem reticulated to the base. Appears early in the season.

**B. felleus** (Bull.) (Lat., full of gall, bitter, from the taste.)
The Noads. Under trees. Poisonous. Tubes pale pink.

**B. castaneus** (Bull.) (Lat., chestnut-like, from the colour.)
Ironshill. Under trees. Tubes very short, free, openings minute, white then yellow.

**Polyporus varius** (Pers.) Fr. (Lat., variable, its size and shape.)
Woodfidley. On trunk of blackthorn. Undulated, tufted; pileus streaked.

**P. fumosus** Fr. (Lat., smoky, from the colour it is tinged.)
Beaulieu Heath. On stumps. Resembles *P. adustus*, but hymenium whitish.

**P. epileucus** Fr. (Gr., upon white, referring to the flesh.)
Cadlands. On log. Rounded above, concave below. Pileus rugged.

**Fomes resinaceus** (Boud.) Rea. (Lat., like resin.)
B. On trunks of oak. Covered with a varnished yellow, then blood-red, or chestnut dust, which is at first shining.

**F. Ribis** (Schum.) Fr. (Lat., of *Ribes*—the habitat.)
B. On currant and gooseberry bushes.

**Poria blepharistoma** B. and Br. (Gr., eyelash-mouthed, from the fine teeth edging the pores.)
B. On dead branches. Very thin, snow-white patches.

**PTYCHOGASTER** Cda. (Gr., *ptuche*, a fold, *gaster*, belly, from the internal structure.)

**P. albus** Cda. (Lat., white.)
B. On trees. Globular. Said to be an imperfect polyporus.

**Hydnum rufescens** (Pers.) Fr. (Lat., becoming reddish.)
L. In woods. Possibly only a thin, rufescent variety of ***H. repandum*** (Massee.).

**H. cinereum** (Bull.) Fr. (Lat., ashy, from the colour of the teeth, etc.
L. In fir woods. Stem light brown.

**H. scrobiculatum** Fr. (Lat., trenched, from the pitted pileus.)
L. In fir woods.

**H. zonatum** (Batsch.) (Lat., zoned.)
Boldre. Shave Green Inclosure. Under firs. Known by the zoned, radiately wrinkled pileus.

**H. udum** Fr. (Lat., damp, from its habitat.)
B. L. On dead branches, forming sub-gelatinous patches, flesh-colour, then pale and yellowish.

**H. farinaceum** (Pers.) Fr. (Lat., mealy.)
B., C., L. On rotten wood, forming thin, white, mealy patches.

**H. fuscoatrum** Fr. (Lat., dusky black.)
B. On dead wood. Teeth with dull-grey points, brown below.

**Grandinia mucida** Fr. (Lat., slimy.)
B., C. On rotting wood. Waxy, somewhat gelatinous when moist, pale dull yellow.

**G. helvetica** Fr. (Lat., of Helvetia, Switzerland.)
L. On fallen branches. Pale-yellowish to deep-ochraceous when fresh, drying alutaceous with a faint greyish tinge, and cracking.

**Craterellus sinuosus** Fr. (Lat., winding, from the wavy margin.)
B. In woods. Greyish-brown, strong scented.

**Corticium praetermissum** (Karst.) Bres. (Lat., omitted.)
B. On bark and wood. Pure white, hymenium becoming cream-colour.

**C. porosum** B. and Br. (Lat., porous, from the scattered depressions.)
L. On wood. Colour of wash-leather.

**C. sulphureum** (Pers. non Fr.) Bres. = *Phlebia vaga* Fr. (Lat., sulphur coloured.)
L. On wood, bark and leaves. Margin bright sulphur-colour.

**C. comedens** Fr. (Lat., eating up, which it appears to do to its support.)
L. Bursting the bark off dead and fallen oak, hazel and plum branches.

**C. confine** Bourd. & Galz. (Lat., adjoining, from its resemblance to *Grandinia*.)
C. On rotten wood. At first snow-white and arachnoid, hymenium eventually deep cream.

**HYPOCHNUS** Fr. emend. Karst. (Gr., *hupo*, under, *chnous*, a fine down or light porous substance, from the looseness of the tissue). Separated from *Corticium* on account of the coloured, warted spores, = *Tomentella*.

**H. caesius** (Pers.) v. H. & L. (Lat., bluish.)
B.

**H. fuscus** (Pers.) Schröt. (Lat., dusky.)
B., L.

**H. botryoides** (Schw.) Wakef. (Gr., like a cluster of grapes, from the appearance of the hymenium.)
L. On bark. Easily recognised by the granular hymenium and the contrast between its dark colour and that of the subiculum and margin. New to Britain.

**H. cinerascens** (Karst.) v. H. & L. (Lat., somewhat ash-coloured.)
L. On bark. Distinguished from *H. fuscus* by the grey colour, smaller spores and thinner, hyaline hyphae. New to Britain.

**H. ferrugineus** (Pers.) Schröt. (Lat., rust-coloured.)
L.

**H. zygodesmoides** (Ell.) v. H. & L. (Gr., like the band joining the yoke to the pole, from its intermediate position.)
B. On rotten bark. Hymenium loose, pinkish to vinaceous-buff. Its pale spores link it to *Corticium*. New to Britain.

**H. subfuscus** (Karst.) v. H. & L. (Lat., somewhat dusky.)
B.

**Peniophora aurantiaca** Bres. (Lat., orange-coloured.)
L.

**P. setigera** (Fr.) Bres. (Lat., bristle-bearing.)
L.

**Clavaria flava** (Schaeff.) Fr. (Lat., golden-yellow.)
E. In woods. Edible. Brittle. Turns reddish when handled.

**C. botrytis** (Pers.) Fr. (Gr., a bunch of grapes.)
R. In woods. Edible. Tips of branches bright red. Fruity smell.

**C. vermicularis** (Scop.) Fr. (Lat., worm-like, from the shape.)
L. Amongst grass. Edible. Densely tufted. White, simple, cylindrical, pointed.

**C. acuta** (Sow.) Fr. (Lat., sharp, from the apex.)
C. On the ground. Solitary, white, simple, swollen above.

**TYPHULA** Pers. (*Typha*, the reed-mace, in miniature, from the shape.) Club slender, stem distinct, thread-like.

**T. erythropus** (Bolt.) Fr. Gr., red-stemmed.)
B. On dead herbaceous stems.

**SEBACINA** Tul. (Lat., *sebum*, tallow, grease, from the texture.) A genus resembling *Corticium* in habit, but with *Tremella*-like (septate) basidia.

[**S. incrustans** (Pers.) Tul. (Lat., incrusting.)
L. Formerly recorded as *Thelephora sebacea* for Hurst Hill.]

**FEMSJONIA** Fr. (From Femsjo, the name of a place.) A genus of jelly-fungi allied to *Exidia*. Cup-shaped, rooting.

**F. luteo-alba** Fr. (Lat., yellow and white.)
B., L. On branches of birch and oak. At first cup-shaped, then plane, finally folded. Disc bright brassy yellow, with a narrow white margin.

**Cyathus vernicosus** (Bull.) Dc. (Lat., varnished.)
C. On the ground. Bell-shaped, smooth.

**Geaster rufescens** (Pers.) Fr. (Lat., becoming reddish.)
Near Park Ground Inclosure. Among short grass. Exoperidiun segments thick, revolute; endoperidium sessile, pale, peristome dentate.

**Bovista plumbea** (Pers.) (Lat., leaden.)
Dilton, C., L. Dry, grassy and heathy places. Inner layer lead-colour. Spores umber-brown.

**B. nigrescens** (Pers.) (Lat., becoming black.)
C. Dry pastures and heathy places. Inner layer blackish-umber. Spores tinged purple.

**Lycoperdon umbrinum** Pers. (Lat., umber-brown.)
L. In woods. Spines free, thin, crowded, soft, fragile, bistre.

**Uromyces Betae** (Pers.) Tul.
Lyndhurst. On Mangel.

**Puccinia Violae** (Schum.) DC.
L.

**P. obtegens** (Link.) Tul.
B.

**P. Leontodontis** Jacky.
L.

**P. Menthae** Pers.
B., L.

**Triphragmidium Ulmariae** (Schum.) Link.
B.

**Phragmidium mucronatum** Schlect.
B.

**P. violaceum** (Schultz) Wint.
B., L.

**Coleosporium Sonchi** Lév.
B.

**Melampsora Hypericorum** (DC.) Schröt.
L.

**M. Larici-Epitea** Kleb.
L. On *Salix.*

**Melampsoridium betulinum** (Pers.) Kleb.

**Urocystis Anemones** (Pers.) Wint.
L. On *Ranunculus.*

**Sphacelotheca Hydropiperis** (Schum.) de Bary.
L.

**Ustilago flosculorum** (DC.) Wint.
E. On *Scabiosa succisa.*

## ASCOMYCETES.

**Sphaerotheca pannosa** (Wallr.) Lév.
L.

**S. humuli** Lév.
Lyndhurst, on *Fragaria vesca.*

**Podosphaera leucotricha** de By.
Lyndhurst, on *Pyrus Malus.*

**Erysiphe communis** (Wallr.) Fr.
L.

**Uncinula Aceris** (DC.) Sacc.
B.

**Nectria episphaeria** (Tode) Fr.
C.

**Epichloe typhina** (Pers.) Tul.
C.

**Cordyceps ophioglossoides** (Ehr.)
Tile Barn Inclosure.

**Eutypa lata** Tul.
C.

**Sphaerella Fragariae** (Tul.) Sacc.
Lyndhurst.

**S. Elodes** A.L.S. & Ramsb.

**Mycosphaerella brassicola** (Duby).
Lyndhurst.

**Melanconis stilbostoma** (Fr.) Tul.
B.

**Diatrype stigma** (Hoffm.) de Not.
L., M.

**Diaporthe arctii** Fckl.
New Park Inclosure.

**Hypoxylon multiforme** Fr.
C.

**Botryosphaeria Dothidea** (Moug.) Ces. & de Not.
C. on *Rosa.*

**Xylaria polymorpha** (Pers.) Grev. var. **pistillaris Nke.**
B.

**Phyllachora Graminis** (Pers.) Fckl.
B.

**P. Junci** (Fr.) Fckl.
L.

**Rhopographus Pteridis** (Sow.) Wint.
L., M.

**Elaphomyces cervinus** (Pers.) Schröt. (= *granulatus* Fr.)
Tile Barn Inclosure.

**Morchella esculenta** Pers.
Calverly. On the ground. Spring and early summer. Edible.

**Otidea onotica** (Pers.) Fckl.
Brockenhurst Park. Ironshill. B.

**O. cochleata.**
Fletchers Thorn.

**O. leporina.**
Wootton Copse Inclosure.

**Ciliaria trechispora** (B. and Br.) Boud. On naked, damp earth.
Perry Wood.

**Lachnea hemisphaerica** (Wigg.) Gill.
C.

**Cheilymenia stercorea** (Pers.) Boud.
Roydon. C.

**C. coprinaria** (Cke.) Boud.
Matley Heath. L.

**Humaria melaloma** Mass. On burnt ground.
Balmer Lawn.

**H. Jungermanniae** Sacc. On *Diplophyllum albicans.*
Bramshaw.

**Ascobolus viridulus** Phill. & Plowr.

**Calycella citrina** (Hedw.) Quél.
L.

**Orbilia leucostigma** Fr.
L.

**O. curvatispora** Boud.

**Sclerotinia Curreyana** (Berk.) Karst. = *S. roseum* Fr.
L.

**Phialea firma** (Pers.) Gill.
B.

**Dasyscypha ciliaris** (Schrad.) Sacc.
L.

**D. fuscescens** (Pers.) Rehm.
L.

**Mollisia melaleuca** (Fr.) Sacc.
R.

## PHYCOMYCETES.

**Pilobolus crystallinus** (Wiggers) Coem. On dung.
Near Rushpole Wood. New Park Inclosure. L.

**P. longipes** van Tiegh.

**Phytophthora infestans** (Mont.) de Bary. On *Solanum tuberosum* and *S. Lycopersicum*.
Lyndhurst.

**Peronospera cubensis** B. and C. On *Cucumis*.
Lyndhurst.

**Synchytrium endobioticum.** On *Solanum tuberosum*.
Allotments, Lyndhurst, near "Crown and Stirrup" Inn (H. V. Taylor).

## DEUTEROMYCETES.

**Phyllosticta ruscicola** Dur and Mont.
B.

**Phoma conigena** Karst
L.

**P. Myricae** Karst.
L.

**P. destructiva Plow.** On *Solanum Lycopersicum*.
Lyndhurst.

**P. nummularis.**

**Ascochyta Armoraciae** Fckl.

**Actinonema Rosae** (Lib.) Fr.
Lyndhurst.

**Septoria Fragariae** Desm.
B.

**S. Rubi** Westend.
L.

**S. Violae** Westend.
L.

**Ceuthospora phacidioides** Grev.
Brockis Hill.

**Oidium alphitoides** Griff. & Maulb.
B., L.

**Ovularia obliqua** (Cke.) Lindau. On *Rumex*.

**O. primulana** Karst.

**Ramularia Ajugae** (Niess.) Sacc.
L.

**R. Cardui** Karst.
B.

**R. Taraxaci** Karst.

**Heterosporium epimyces** Cke. and Massee.
B.

**Macrosporium Solani** Cke.
Lyndhurst.

**Isaria arachnophila** Ditm. On dead spider.
Brockenhurst.

**Aegerita candida** Pers.
L.

**Fusarium Solani** Mart.
Lyndhurst.

## MYCETOZOA.

**Badhamia foliicola** Lister. Developed from yellow plasmodium.

**Stemonitis flavogenita** Jahn. Developed from plasmodium.

**Comatricha nigra** (Pers.) Schröt.

**Cibraria pyriformis** Schrad. Developed from rotten wood brought from Lyndhurst.

**Dictydium cancellatum** (Batsch) Macbr. Var. **fuscum** Lister.

**Lycogala epidendron** (L.) Fr.
L.

**Trichia decipiens** (Pers.) Macbr.
L.

**T. favoginea** Pers.
Brockenhurst.

**Arcyria cinerea** (Bull.) Pers.
L.

**A. denudata** (L.) Sheldon.
L.

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